

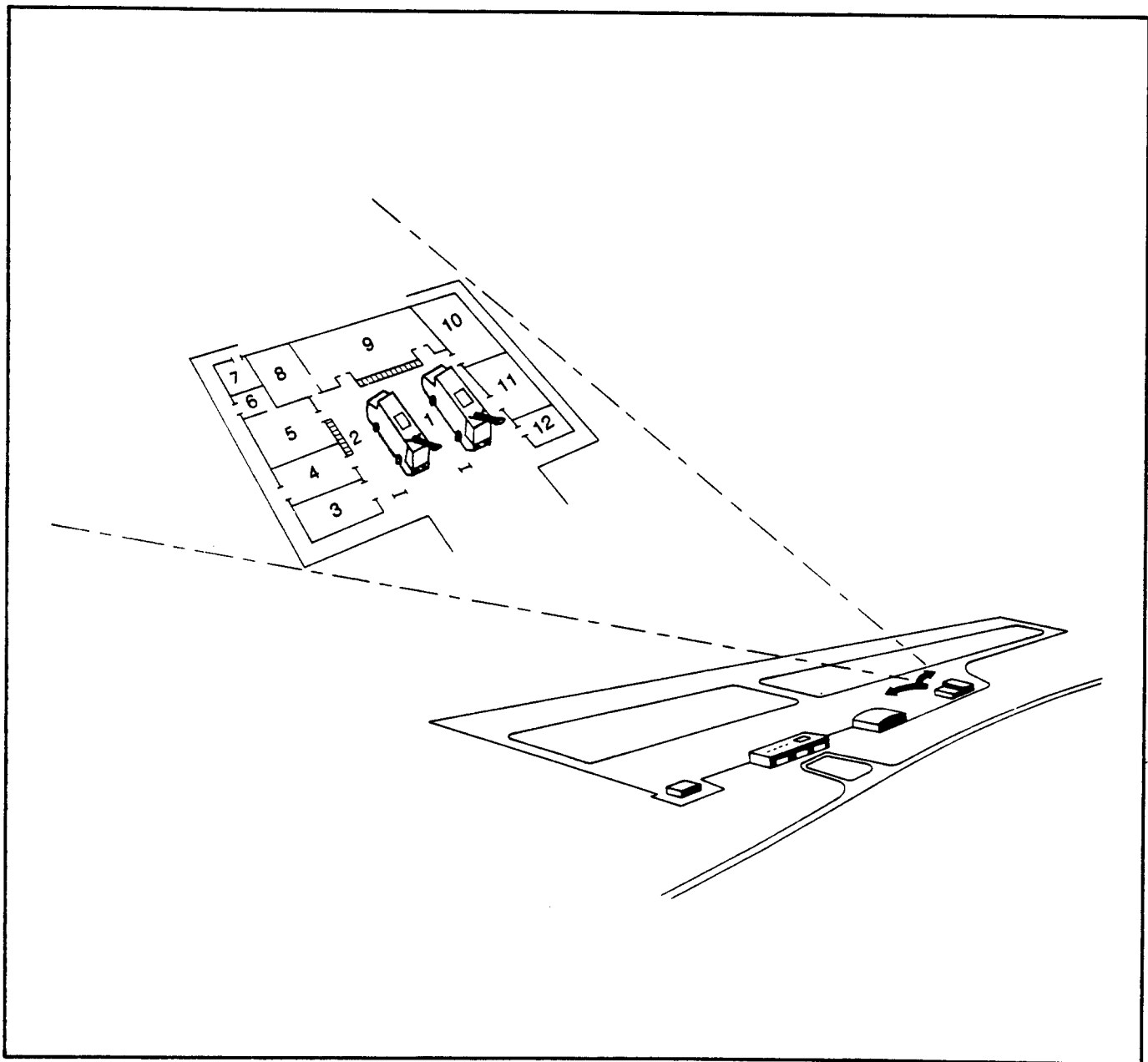


U.S. Department
of Transportation
**Federal Aviation
Administration**

Airport Rescue and Firefighting Station Building Design

Advisory Circular 150/5210-15

Date: July 30, 1987





U.S. Department
of Transportation

**Federal Aviation
Administration**

Advisory Circular

Subject: AIRPORT RESCUE AND FIREFIGHTING
STATION BUILDING DESIGN

Date: 7/30/87
Initiated by: AAS-120

AC No: 150/5210-15
Change:

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1. PURPOSE. This advisory circular (AC) provides standards and guidance for planning, designing, and constructing an airport rescue and firefighting station.
 2. CANCELLATION. Advisory Circular 150/5210-10, Airport Fire and Rescue Equipment Building Guide, dated December 7, 1967, is cancelled.
 3. APPLICATION. The standards and guidance contained herein are recommended by the Federal Aviation Administration for use in the design and construction of airport rescue and firefighting stations. FAA standards, where noted, are mandatory for those projects involving federal funds. **FAA STANDARDS ARE IDENTIFIED BY BOLDFACE CAPITALS.** When necessary to meet local conditions, room sizes and other areas specified herein may be increased up to 20 percent.
 4. METRIC UNITS. To promote an orderly transition to metric (SI) units, this AC contains both English and metric dimensions. The metric conversions may not be exact and pending an official changeover to the metric system, the English dimensions govern.

LEONARD E. MUDD
Director, Office of Airport Standards

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CHAPTER 1. INTRODUCTION

1. OVERVIEW. The primary objective of an aircraft rescue and firefighting (RFF) service is to save lives by minimizing the effects of an aircraft accident or incident. Optimizing the location of the airport fire station and station design enhances the effectiveness and efficiency of service personnel. Station site selection which emphasizes operational RFF vehicle factors lowers emergency response times. Further time reductions are attainable by stations built to the vehicle room, station hallway, and apron dimensional standards of this advisory circular. Station operations can be more efficient and cost-effective by implementing an overall station system design thereby eliminating operational shortcomings. This approach interrelates the major station subsystems, e.g., HVAC, electrical, and piping systems. Human engineering, which promotes not only personnel safety but more alert and ready individuals, is included.

2. PROJECT PHASES. Although project phase activities may vary in detail according to the specific needs of each individual airport, the following project phases, with their own substeps, lead to a functional and cost-effective station.

a. The Planning Phase.

(1) Initial Planning Decisions.

(i) Expanded or New Aircraft Rescue and Firefighting Station. The sponsor should determine whether it is more cost-effective to expand an existing station or to construct a new one in meeting aircraft RFF service needs. Once the decision has been made, the requirements of the expanded or new station should be clearly and precisely defined. This list of requirements influences all aspects of planning, designing, and construction. The airport master plan, which integrates all aspects of airport planning, short-term and, more important, long-term development needs, can assist in this determination.

(ii) Single or Dual Station Functions. The sponsor should decide whether the station will have the sole function of aircraft RFF or dual functions. Some common practices are to house both aircraft RFF vehicles with airport snow removal equipment or structural firefighting vehicles. Other double duties include permanent or temporary medical treatment facilities, security offices, and maintenance terminals. Precautions should be taken, though, that the aircraft RFF vehicle room is separated from the facilities of other airport departmental functions to avoid delayed emergency vehicle responses and operational conflicts.

(iii) Single or Multiple Aircraft Rescue and Firefighting Stations. For larger airports with several runway patterns, a zonal coverage by multiple stations is often the answer, not only to meet vehicle response times, but to shorten response times to high risk areas. Aircraft accident studies show that a large number of aircraft mishaps occur on or near the runways (see figure 1). The more serious accidents, in terms of casualties and fire control conditions, occur in or beyond the runway end safety areas. Where more than one station is provided, one station should be designated the master station and the other(s) as satellite(s). Usually, the range and extent of the facilities vary between those which are more appropriate for the master station and those at a satellite.

(iv) Vehicle Fleet Requirements. Federal Aviation Regulation (FAR) Part 139, Certification and Operations: Land Airports Serving Certain Air Carriers, establishes the minimum amount of fire extinguishing agent required for each certificated airport together with the minimum number of aircraft RFF vehicles required to transport the agent. There are a number of alternate combinations of aircraft RFF vehicles and agents used to comply with these requirements. The number and type of aircraft RFF vehicles to be in the fleet are the starting point for aircraft RFF vehicle room space allocations. This number drives the design for the majority of the remaining station rooms and other station elements. For example, it governs the design and space designated for dormitories, lavatories, the kitchen, watch/alarm room, and other key station elements.

(2) Selection of an Architect and Engineer (A/E). The expertise, advice, and counsel rendered by a licensed architect and engineer (A/E) are essential to the airport sponsor. AC 150/5100-14A, Architectural, Engineering, and Planning Consultant Services for Airport Grant Projects, provides sponsors with guidance in the selection and employment of architectural, engineering, and planning consultants. Additionally, it provides guidance on contract format and provisions, methods of contracting, and allowable costs. It should be noted that if the station is to be constructed as a part of a Federal airport grant project, the selection of the A/E should conform to OMB Circular A-102, Attachment O. The selected individual should know or learn the needs of aircraft RFF service personnel and their specific operations. Basic A/E duties in addition to design, are to oversee construction, assist in the negotiations between the contractor and the airport sponsor, and ensure that all contractual obligations are met in accordance with the plans and specifications.

(3) Selection of a Project Team. A closely integrated team of diverse professionals should be organized to plan and monitor the project. The team should include design consultants such as the architect and engineer (A/E), airport planners, non-Federal authorities funding the project, and at least one person from airport operations and aircraft RFF service. Where no formal aircraft RFF service exists at the airport, a representative from the organization that will provide the service personnel should be a member of the team. Firefighter participation in the design of the station is a good source of operational requirements. Their first-hand knowledge of other station shortcomings and assets is a vast resource of useful information. When deemed necessary, assign others to the team to provide added expertise. With such a diversity of team skills, all probable ramifications of a decision are normally considered and chances for mistakes and omissions reduced.

(4) Data Collection. Inventory and/or projected airport requirements for between 15 and 25 years should be gathered. The data collection should at least include the following:

(i) Planned airport development and/or expansion.

(ii) Current and forecasted airport operations.

(iii) Aircraft RFF service needs as a function of the airport's present and future airport indices.

(iv) Projected life-cycle costs (consider both initial and long-term costs of ownership).

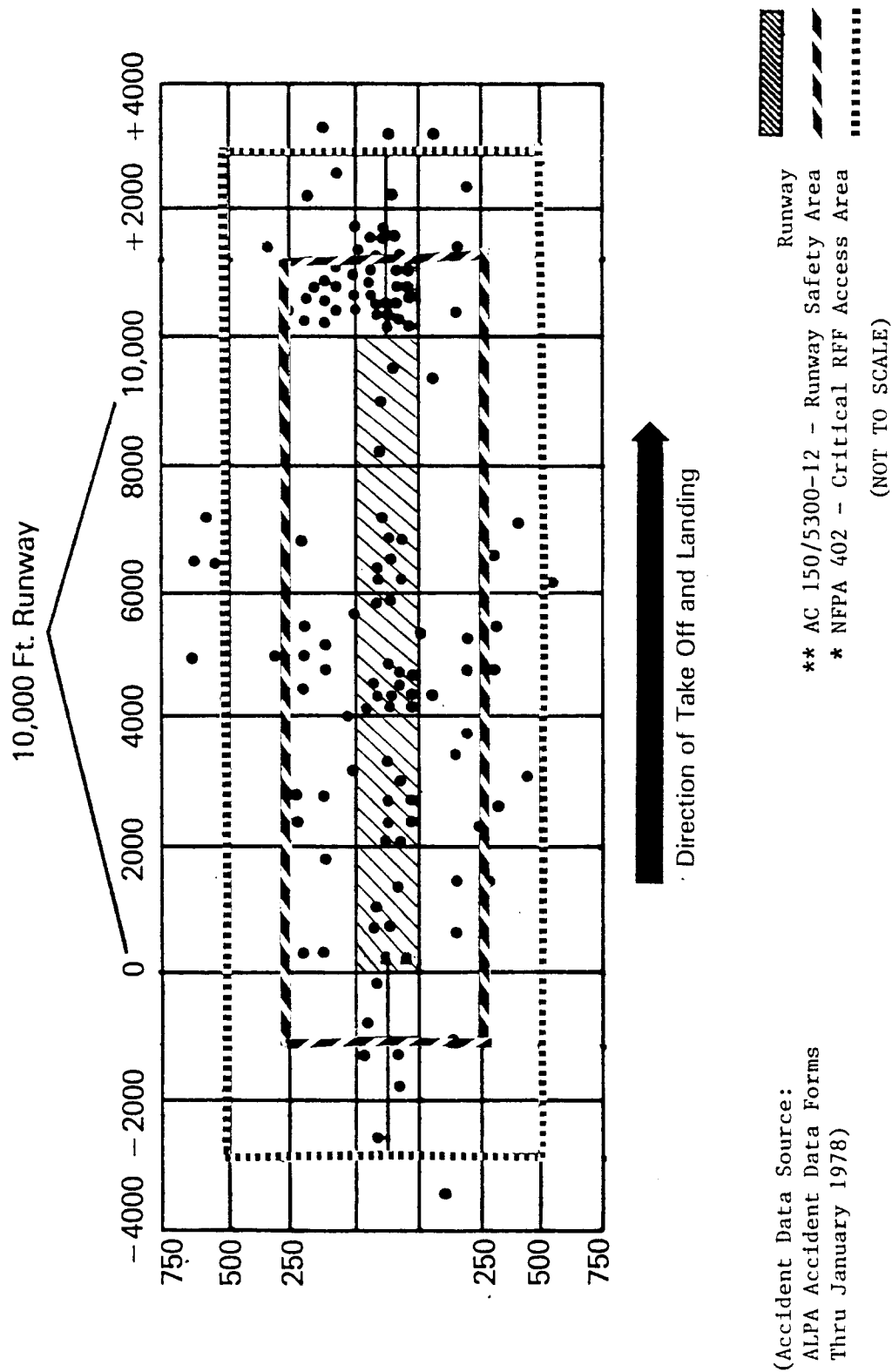


Figure 1. Accident Site Distribution Within the Critical Rescue and Firefighting Access Area (*) and the Runway Safety Area(**)

- (v) Facilities provided by existing fire station(s) and building(s).
- (vi) Service personnel requirements.
- (vii) Equipment requirements, including such new technology as computerized systems for communications and building systems operation.
- (viii) Standardized hose fitting sizes which can be shared by non-airport RFF support units.
- (ix) Need for special equipment and practices for solving specific problems (e.g., quick disconnect fittings for use with older aircraft RFF vehicles that require constant air pressure and have no on-board compressor).
- (x) Requirements for notification of proper authorities, e.g., the FAA (see AC 150/5370-2C, Operational Safety on Airports During Construction).
- (xi) Requirements for the handling/storing of hazardous materials.

b. The Design Phase. Integrating the airport's requirements with the cost, schedule constraints, and preparing plans and specifications requires the airport sponsor's and the project team's involvement from the earliest decisions through the completed schematic designs. AC 150/5300-9A, Predesign, Prebid, and Preconstruction for Airport Grant Projects, describes appropriate purpose, timing, participants, and agenda items for each of these group meetings. Approval by the sponsor and the project team should precede initiation of subsequent stages. Sponsor approval should include any necessary adjustment of the airport master plan to reflect the proposed location of the station(s) and the modification of building restriction lines (BRL) to preclude future airport construction from interfering with the station surveillance of the movement area. Activities encountered to accomplish a completed project design include the following.

- (1) Schematic Designs. Upon completion of schematics, the sponsor and the A/E should identify estimated cost, construction materials and equipment needed, items to be included in the contract documents, and other items of operational importance.
- (2) Cost. After the A/E develops a station outline from the list of requirements, a rough cost approximation of a conceptualized station should be established.
- (3) Design Development. This stage should emphasize station constructibility. Any uncertainties in the station subsystems such as structural, electrical, and construction material details should be worked out and accordingly reflected on the schematics.
- (4) Plans and Specifications. This stage should focus on establishing construction drawings, plans, and specifications. Specific construction materials, workmanship, and special construction conditions need to be identified. Before bidding begins, the sponsor should undertake a final project design review and incorporate any modifications necessitated by changes that may have occurred after the planning phase, such as in personnel requirements, technology, or building regulations.

(5) Approvals. Station designs must comply with local and state building codes and other Federal requirements where appropriate. If these requirements exceed or are more stringent than those contained in this advisory circular, they shall take precedence. Administrating agencies may require station drawing approval and issuance of a building permit prior to construction. In areas subjected to earthquakes, hurricanes, heavy snow loads, heavy driving rain, hail, or high winds, stations should use materials designed to withstand such phenomena.

c. The Construction Phase. The construction phase includes all activities required after the award of a construction contract.

(1) Resident Engineer. Periodic inspection by a resident engineer^a of the work in progress may be part of the basic services offered by the contracted A/E firm. If the sponsor desires such an inspection service, it must be addressed within the contract. Full-time inspection may be provided by either the sponsor or the A/E firm. The presence of a resident engineer provides some assurance that the contractors are complying with the terms of the contract through acceptable workmanship and materials. The individual should have experience in fire station construction and knowledge of proper installation and operation of fire service systems. AC 150/5370-12, Quality Control of Construction for Airport Grant Projects, provides a list of primary duties and responsibilities of a resident engineer. Also see AC 150/5300-9A, Predesign, Prebid, and Preconstruction for Airport Grant Projects.

(2) Airport Operations. The construction of an expanded or a new station should not interfere with normal airport operations or aircraft RFF service. During construction, careful observation should be maintained to ensure that airport operational safety is not degraded by construction hazards. AC 150/5370-2C, Operational Safety on Airports During Construction, provides guidance on safety considerations, sponsor's responsibilities to ensure operational safety, construction vehicle activity, and special safety requirements during construction. Again, see AC 150/5300-9A, Predesign, Prebid, and Preconstruction for Airport Grant Projects.

d. The Occupancy Phase. After a station has been completed, the airport sponsor should have aircraft RFF service personnel check the facilities and test every system and piece of equipment for proper installation and operation prior to station occupancy. Note any deficiencies and report them to the A/E for correction.

CHAPTER 2. SITE SELECTION

3. RESPONSE TIME. A principal ingredient affecting the aircraft RFF vehicle response time is the location of the airport RFF station. During the planning stage a qualified team should undertake an indepth analysis to determine which potential sites not only comply with Federal Aviation Regulation (FAR) Part 139, but yield the quickest response time. All candidate sites noted on the airport layout plan should be evaluated in optimizing site location.

4. CHECKLIST ITEMS. The following checklist stresses aircraft RFF vehicle response factors, station operations, and cost-effectiveness. All candidate sites should be rated in each of the following areas.

a. Operational Response Factors. The site allows for:

- (1) Immediate, straight, and safe access towards the airside.
- (2) Unimpeded access routes with a minimum of turns to runways, taxiways, and aircraft parking areas.
- (3) Direct access to the terminal aprons without crossing active runways, taxiways, or difficult terrain.
- (4) Noninterference with the air traffic control tower's (ATCT) line of sight.
- (5) Maximum surveillance of the air operations area.
- (6) Shortest response times to the most probable aircraft accident areas.
- (7) Compliance with building restriction lines (BRL).
- (8) Future additions or expansion of the station without:
 - (i) limiting or reducing airport surveillance.
 - (ii) blocking fire traffic lanes.
 - (iii) intruding on adjacent roads, buildings, aprons, runway or taxiway clearances, and air traffic control tower's line of sight.
- (9) Airport expansion, such as new runways or extensions that will not jeopardize its emergency service areas by creating emergency response runs of excessive length.
- (10) Noninterference by aircraft RFF vehicle or station's telecommunications equipment with airport navigational facilities.

(11) Minimum obstructions or interference from existing facilities or uses, such as:

- (i) access roads.
- (ii) fueling areas.
- (iii) aircraft taxiing operations or parking areas.

b. Lot Size. The size of the lot allows for:

(1) The accommodation of the station and future additions or expansions to the structure(s), such as increases in aircraft RFF equipment or personnel.

(2) Exterior amenities, such as employee automobile parking or aircraft RFF vehicle servicing areas.

c. Physical Facilities. The site offers reasonable access to:

- (1) Electrical power and, if any, alternate energy sources, e.g., gas.
- (2) Essential telephone communications.
- (3) Existing airport access and service roads.
- (4) An airport water supply system and, if any, sewer hookups.

d. Topography and Station Orientation.

(1) A level site is preferred, however, an irregular nonlevel site can at times be used cost-effectively. An experienced architect/engineer (A/E) may be able to utilize such locations and thereby possibly reduce the lot size and station cost.

(2) Proper station orientation can reduce yearly energy operating cost by moderating the effects of the wind and the sun's rays and can lower exterior noise level exposures and the associated costs for acoustical treatment.

e. Accessibility by Personnel. Some airports staff their aircraft RFF vehicles with volunteers or auxiliary personnel employed by either the airport or the airlines. If so, the aircraft RFF vehicles should be easily accessible to the principal drivers, volunteers, and other auxiliary personnel in meeting any required emergency response times.

Examples of functional single and multiple site locations are shown in figures 2, 3, and 4.

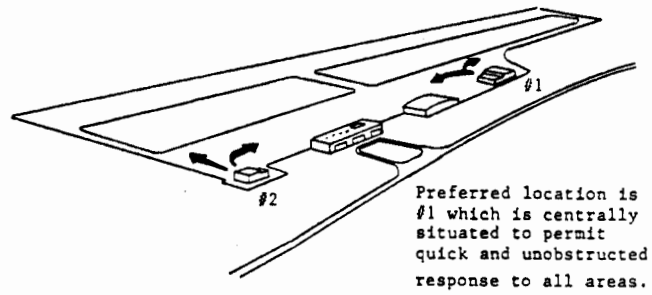


Figure 2. Small size airport with a single rescue and firefighting station

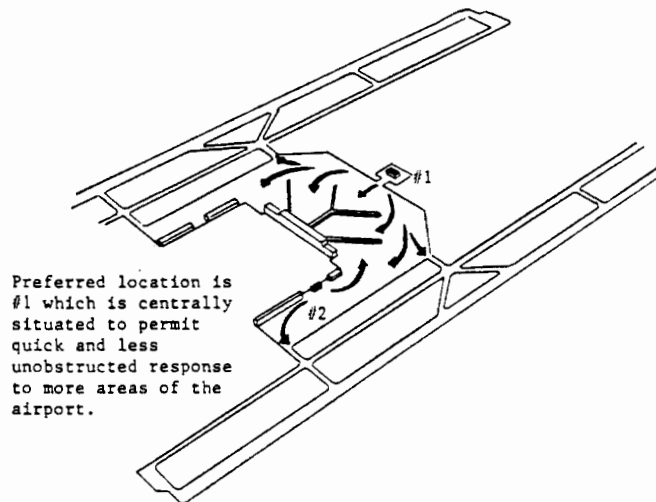


Figure 3. Medium size airport with a single rescue and firefighting station

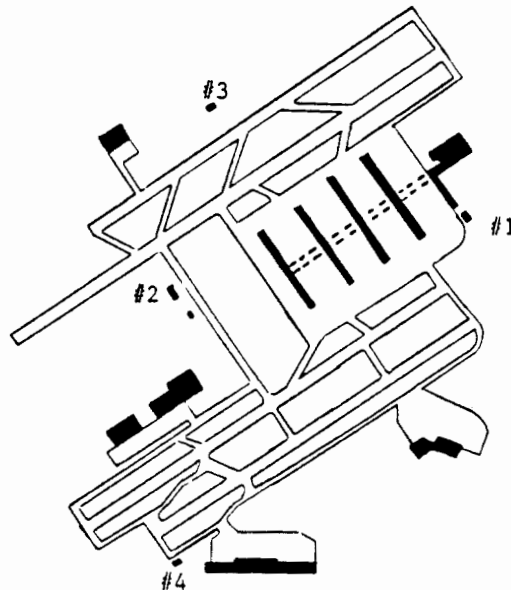


Figure 4. Large size airport with a main station, e.g., #1, and three airport rescue and firefighting satellite stations

5. GRAPHICAL ESTIMATES OF VEHICLE RESPONSE TIMES. The final test of station site acceptability rests in meeting the response time requirements of FAR Part 139. When a multiple of candidate sites are to be evaluated, a methodology based on the performance curves of the airport's operational aircraft RFF vehicle(s) may be used for estimating vehicle response times to any point within the movement area (see report # FAA-RD-78-105, Full-Scale Fire Modeling Tests of a Compact Rapid Response Foam and Dry Chemical Powder Dispensing System). Using a large-scale airport layout plan, these estimates can be used to rule out those sites that clearly fail response time requirements. Promising sites can then be further evaluated by actual time trials for satisfying response time requirements of FAR Part 139. This methodology requires that the following data be generated by in-house trials using the airport's aircraft RFF vehicle(s):

a. Straight line acceleration and deceleration speeds from zero to maximum and the corresponding distances transversed.

b. Cruise speed.

c. Safe entrance and exit turn speeds with the respective times and distances covered for common turning segments expected at the airport (45°, 60°, and 90°).

CHAPTER 3. STATION ELEMENTS

6. INTRODUCTION. Federal Aviation Administration (FAA) airport certification requirements establish the payload size and the required number of aircraft rescue and firefighting (RFF) vehicles. The number of vehicles and their characteristics then drive the operational design requirements of the station's vehicle room. The approved number of vehicles also dictates the size of the crews needed for successful operation. Consequently, living and working space allocations for most of the remaining station rooms will be based on this staff. The watch/alarm room, mechanical room, and the apron design, etc., will also be affected by the overall design and operational requirements of the vehicle room. To assist in assessing these needs, the following appendices have been included: appendix 1, dimensions, minimum crew requirements, and other characteristics of sample aircraft RFF vehicles; appendix 2, typical items purchased as part of the construction and furnishing of a station; and appendix 3, a list of questions that should be answered for equipment purchases. Also, examples of station layouts are shown in figures 5, 6, and 7.

7. AIRCRAFT RESCUE AND FIREFIGHTING VEHICLE ROOM. The aircraft rescue and firefighting (RFF) vehicle room is the primary station element. It governs the layout and structural design of the majority of other station elements and directly influences the successful operation of the aircraft RFF service.

a. Layout. Room dimensions depend on the vehicle parking concept and the physical characteristics and number of RFF vehicles to be housed.

(1) SERVICE PERSONNEL SHALL HAVE OBSTACLE FREE ACCESS FROM ALL INTERIOR AND EXTERIOR (PATIO) STATION POINTS TO THE VEHICLE ROOM.

(2) Side-by-side parking of vehicles is preferred over tandem parking, since, if a mechanical failure in the lead tandem parked vehicle occurs, it will hinder or negate the response of the rear vehicle. If tandem parking is unavoidable, limit it to structural firefighting and other secondary vehicles. Whenever practical, long and short vehicles should be parked side by side for more efficient use of vehicle room space.

(3) Whenever possible, use drive-thru bays to facilitate parking of vehicles and to increase the operational safety and flexibility of the station.

(4) THE AIRCRAFT RFF VEHICLE STANDARD CLEARANCES WILL BE AT LEAST: 6 FEET (1.8 M) BETWEEN THE VEHICLE AND WALLS/STORAGE AREAS; 8 FEET (2.4 M) BETWEEN VEHICLES PARKED SIDE BY SIDE; 5 FEET (1.5 M) BETWEEN VEHICLES PARKED END TO END; AND 5 FEET (1.5 M) BETWEEN THE VEHICLE AND STALL BAY DOORS. More clearance may be required for folding bay doors. Dimensions should accommodate the present vehicle fleet and newer replacement vehicle models. Additional consideration should be given to larger future vehicle additions which may be a result of an increase in the airport's index.

(5) The ceiling height should allow service personnel to stand erect on top of vehicles and still clear any overhead obstructions, such as pipes, storage tanks, bay door mechanisms, etc. THE STANDARD CLEARANCE BETWEEN THE CEILING HEIGHT AND THE AIRCRAFT RFF VEHICLE WORK PLATFORM IS 7 FEET (2.1 M).

1. Vehicle Room/Turnout Gear Storage/
Hose-Drying Racks
2. Watch/Alarm Room/Fire Department
Office/Kitchen
3. Dormitory/Study/Lavatory/Shower/Lockers
4. Storage/Work Shop Room

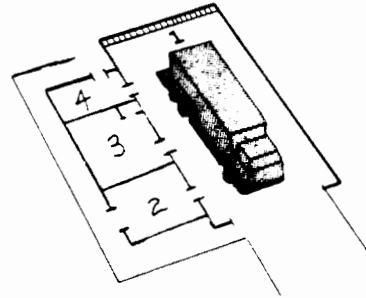


Figure 5. Example of a small size station layout

1. Vehicle Room
2. Turnout Gear Storage
3. Watch/Alarm Room
4. Fire Department Office
5. Training/Study Room
6. Kitchen/Dining Room
7. Mechanical Room
8. Lavatory/Shower/Lockers
9. Dormitory
10. Storage/Hose-Drying Room
11. Work Shop Room
12. Day Room

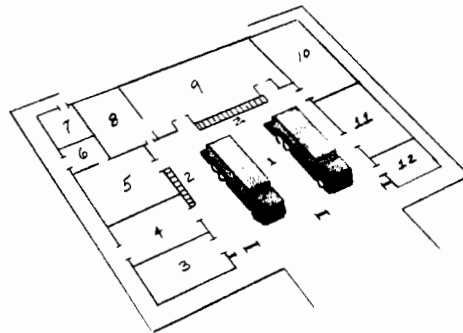


Figure 6. Example of an average size station layout

1. Vehicle Room
2. Turnout Gear Storage
3. Watch/Alarm Room
4. Fire Department Office
5. Work Shop Room
6. Storage Room
7. Hose-Drying Room
8. Dormitory
9. Lavatory/Shower/Lockers
10. Mechanical Room
11. Dining Room
12. Kitchen
13. Training/Study Room
14. Day Room

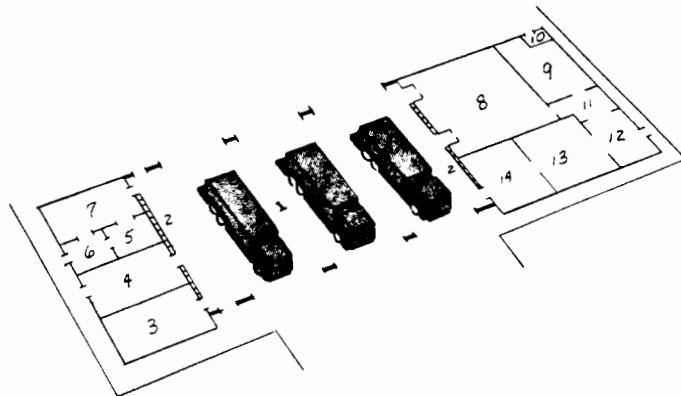


Figure 7. Example of a large size station layout

(6) Storage for turnout gear is required at or near the vehicles. Storage may be in either lockers or open racks. THE STANDARD FOR STORAGE IS AT LEAST 4 SQUARE FEET (0.37 SQUARE METER) PER FIREFIGHTER. The storage area should receive sufficient natural or forced ventilation to completely air-dry clothing between shifts. To minimize the movements of personnel in front of vehicles, storage areas should be located behind the vehicles or, for drive-thru bays, to the side.

b. Electrical Details.

(1) Recommended lighting levels are discussed in Paragraph 33, Lighting.

(2) Convenience electrical outlets on usable walls should be approximately 18 to 24 inches (46 to 61 cm) above the floor with 8-foot (2.4 m) centers. Outlets should not be recessed into the vehicle bay floor.

(3) A 220 volt receptacle to service all vehicles and a retractable 20 amp 120 volts AC power cord per vehicle bay is recommended.

(4) An appropriate electrical supply should be provided for vehicles fitted with engine heaters, battery charging devices, or other protective equipment. All such connections should be designed for quick and safe disconnection.

c. Interior Environment.

(1) An automatic means of transporting vehicle exhaust fumes to the external environment is recommended to avoid air contamination within the vehicle room (see Paragraph 39, Ventilation). Smoke detectors may be used to detect excess exhaust fumes.

(2) A separate heating control is recommended to maintain a vehicle room temperature of at least 55°F (13°C). Paragraph 41, Room Temperatures, provides recommended station room temperatures. In stations where high ambient temperatures and humidity are prevalent, some form of climate control may also be necessary.

(3) To conserve energy, an automatic heater shutoff device should be installed that is activated when vehicle bay doors are opened.

(4) Wall surface materials should have easy-to-clean and maintenance-free qualities. Wall finishes should be selected for long-term maintenance-free characteristics rather than initial low cost.

d. Vehicle Support Equipment.

(1) One overhead hoist with a minimum working capacity of one ton is recommended for the lifting of foam drums, nitrogen tanks, and other equipment onto the vehicles.

(2) A water connection for the refilling of a vehicle's water tank is recommended (see AC 150/5220-4A, Water Supply System for Aircraft Fire and Rescue Protection).

(3) A nearby utility room or designated area within the vehicle room with a hot and cold water source, a deep slop sink, and mop ringer should be provided.

(4) A compressed air supply with operating pressure of at least 120 psi (825 kPa) should be provided for maintenance, vehicle readiness, painting, and cleaning. In stations that have vehicles without on-board air compressors, air connections should be of hydraulic quick-disconnect couplings that facilitate response times and avoid air losses upon disconnection.

(5) A SOURCE FOR FOAM AGENT RECHARGE SHALL BE PROVIDED. ALTERNATIVES ARE EITHER A SINGLE COMMON OR INDIVIDUAL BAY FOAM STORAGE TANKS OR A STORAGE AREA WITH A PORTABLE PUMP THAT HOUSES FOAM CONCENTRATE CONTAINERS ABOVE 32°F (0°C). CAPACITY SHALL BE SUFFICIENT TO FILL ALL VEHICLES WITH AT LEAST TWICE THEIR ASSIGNED CAPACITY. For built-in supply facilities, an overflow system to capture excess foam should be provided.

e. Vehicle Bay Doors.

(1) THE STANDARDS FOR THE SMALLEST INSTALLED VEHICLE BAY DOOR ARE 14 FEET (4.3 M) IN WIDTH AND 15 FEET (4.6 M) IN HEIGHT.

(2) THE STANDARD FOR THE MAXIMUM TIME TO FULLY OPEN ANY VEHICLE BAY DOOR IS 15 SECONDS. This can be achieved by manual remote control from the alarm/watch room or from the side(s) of each vehicle bay door, manually from a door pull chain, or automatically by the alarm system. Manual door pull chain should be placed on the driver's side. For vehicles with center consoles, pull chain placement should be on the left side.

(3) ELECTRIC VEHICLE BAY DOORS SHALL HAVE A MANUAL OVERRIDE THAT IS OPERABLE BY ONE PERSON AND SHALL FULLY OPEN ANY VEHICLE BAY DOOR WITHIN THE MAXIMUM 15 SECOND OPENING STANDARD.

(4) An automatic vehicle bay door retractor should be installed to reverse the downward motion of a door upon contact with an individual or equipment. Pneumatically operated sensing devices are not reliable in areas subject to sustained cold weather.

(5) A vehicle bay door window should be placed to enable one to see the apron from both the vehicle bay floor and the vehicle's driver seat.

(6) For energy conservation and noise attenuation, vehicle bay doors should be insulated and weatherstripped.

f. Vehicle Room Floor.

(1) Vehicle room floor design should not only support the current heaviest loaded vehicle but make allowances for an increase in future vehicle weights. If an adjacent room's floor height is to be different from the vehicle room floor, the recommended difference is approximately 6 inches (15 cm) between the two with the vehicle room floor being the lower.

(2) Floor surface finishes should be resistant to hydrocarbon fuels, foam concentrates, antifreeze, battery acid, etc., and be smooth and easy to clean. This can be achieved on concrete floors by a hard-top, sealed concrete finish. Additionally, the floor finish should not be slippery when wet.

(3) The recommended slope of the vehicle room floor to the drain(s) is 1 inch to 10 feet (2.5 cm to 3 m).

(4) One transverse drain with heavy gauge covers should be located at the vehicle bay door(s) to receive surface water from the bay(s) and the forecourt. It is further recommended that each bay have either a shallow trough or catch basin floor drain equipped with a sediment/grease trap. Troughs are preferable in cold climates because of the greater ease in handling ice and snow that may be brought into the station by vehicles during winter.

g. Sliding Poles.

(1) Sliding poles should be located to minimize the time to reach a vehicle from an upper floor. To reduce the potential for sliding down into obstructions, e.g., vehicle doors left open, sliding poles should be installed near the walls of the vehicle room or in recessed alcoves.

(2) THE CLEARANCE STANDARD OF A SLIDING POLE RADIUS, THE CENTER OF THE SLIDING POLE TO THE NEAREST OBSTRUCTION, SUCH AS WALLS, PIPES, VEHICLE BAY DOOR TRACKS, ETC., IS AT LEAST 30 INCHES (76 CM). THIS STANDARD APPLIES TO THE ENTIRE LENGTH OF THE SLIDING POLE.

(3) Before any final location of a sliding pole is made, a final check should be made that there are no ceiling/floor pipes, wiring, structural members, or other obstructions that will interfere with its installation.

(4) After installation, the spring that activates the flaps should be adjusted to permit both the heaviest and lightest anticipated firefighters to safely use the sliding pole. This adjustment is particularly important at stations where a wide range of individual weights exist.

(5) It is recommended that lights be provided over sliding pole areas, including their landings, that are activated by the alarm system.

8. STATION APRON.

a. General Design.

(1) An apron/driveway design should provide responding RFF vehicles a straight access from the vehicle room floor to the movement area without any curves or other encumbrances that will increase the response time.

(2) There should be an exterior wall water connection or a hydrant fitted with both garden hose and 2-1/2 inch (6.4 cm) National Standard Fire Hose threads.

(3) A warning beacon should be provided if the station has pedestrian or vehicle traffic crossing the apron/driveway. It should be activated automatically whenever a station vehicle bay door is opened during an emergency.

b. Apron Standards and Recommendations. THE APRON OPERATING SURFACE SHALL BE LARGE ENOUGH TO ALLOW THE LONGEST VEHICLE OR THE ONE THAT HAS THE GREATEST OPERATING CIRCLE ^{1/} TO BACK INTO ANY BAY OF THE STATION.

(1) Apron Width. THE WIDTH OF AN APRON FOR MULTI-BAY STATIONS AND SINGLE BAY SINGLE VEHICLE STATIONS SHALL BE AT LEAST EQUAL TO THE DISTANCE BETWEEN THE OUTERMOST LEFT AND RIGHT VEHICLE BAY DOOR OPENING(S) PLUS 3 FEET (1 M) ADDED TO EACH SIDE OF THIS DISTANCE. FOR SINGLE BAY TANDEM VEHICLE STATIONS, THE WIDTH OF AN APRON SHALL BE AT LEAST 28 FEET (8.5 M) WIDE FOR ITS FULL LENGTH, ORIENTED ASYMMETRICALLY TO THE LEFT OR RIGHT.

(2) Apron Length. THE APRON SHALL EXTEND FROM THE VEHICLE BAY DOOR(S) AT FULL-WIDTH FOR AT LEAST $1\frac{1}{2}$ VEHICLE LENGTHS OF THE LONGEST VEHICLE. APRONS LONGER THAN $1\frac{1}{2}$ VEHICLE LENGTHS ARE TO BE GRADUALLY TAPERED DOWN TO A WIDTH NOT LESS THAN 28 FEET (8.5 m) FOR MULTI-VEHICLE STATIONS. The 28-foot (8.5 m) standard allows two vehicles to operate side by side in case one malfunctions while responding to an emergency by furnishing a disabled vehicle pad. SINGLE VEHICLE STATION APRONS MAY BE GRADUALLY TAPERED DOWN TO A WIDTH NOT LESS THAN 12 FEET (3.7 M).

(3) Apron Strength. THE APRON OPERATING SURFACE FOR AT LEAST ONE VEHICLE LENGTH FROM THE VEHICLE BAY DOOR SHALL BE THE SAME STRENGTH SPECIFICATION AS THE VEHICLE ROOM FLOOR.

(4) Gradient. THE APRON SHALL SLOPE AWAY FROM THE STATION AND VEHICLE ROOM FLOOR FOR EFFECTIVE DRAINAGE. Recommended apron slopes are from 2 percent to 4 percent. THERE SHALL BE A SMOOTH TRANSITION BETWEEN THE APRON AND THE VEHICLE ROOM FLOOR.

(5) Marking. An apron alignment stripe should extend from the back of the vehicle room floor out onto the apron a distance equal to the length of the longest vehicle in the fleet. The recommended alignment stripe is a 3-inch (7.6 cm) wide paint stripe on the left side of each vehicle lane.

(6) Lighting. Apron lights should be mounted so as not to interfere either with the drivers' vision when leaving or returning to the station or with other airport operations, e.g., the air traffic control tower's line of sight. Special care should be given to ensure that apron lights do not reflect from vehicle mirrors when vehicles are being backed into the station.

^{1/} The operating circle is the circle circumscribed by the outermost point on a vehicle (e.g., a bumper or mirrors). This circle can be significantly larger than that circumscribed by the vehicle's wheels.

9. WATCH/ALARM ROOM. AIRPORT FIRE STATIONS SHALL HAVE A CENTRAL POINT FOR RECEIVING EMERGENCY CALLS, DISPATCHING AIRCRAFT RFF VEHICLES, AND MOBILIZING AND DIRECTING OTHER SUPPORT RESOURCES. This central point, called the watch/alarm room, depends on the reliability and effectiveness of its alarm(s) and communication systems. Attendants should receive, evaluate, and act on requests for assistance with a minimum of room activity and outside consultation.

a. General Design. The watch/alarm room should provide for maximum surveillance of the movement area and control and observation of vehicle room activities. If necessary for airfield surveillance, the watch/alarm room may be elevated. Other design items follow.

(1) THE STANDARD ROOM SIZE FOR THE WATCH/ALARM ROOM IS AT LEAST 100 SQUARE FEET (9.3 SQUARE METERS) FOR ALL AIRPORT INDICES EXCEPT AIRPORT INDEX A WHICH COMBINES THIS ROOM WITH THE FIRE DEPARTMENT OFFICE. This space is required for recording emergency information and maintaining the fire station's logbook. Also, there should be an accessible storage space for maps and charts of the surrounding airport area.

(2) ALTERNATE EMERGENCY (BACKUP) POWER SHALL BE PROVIDED FOR THE ALARM SYSTEM AND ESSENTIAL COMMUNICATIONS EQUIPMENT.

(3) All electronic equipment and wiring should be conveniently accessible for maintenance and repair.

(4) External night surveillance can be improved by the installation of a dimmer to reduce the intensity of the room's interior lighting.

(5) A lavatory should be conveniently accessible.

(6) A clock with both 12 and 24-hour display formats is recommended.

(7) There should be adequate room sound suppression measures to offset generated high noise levels by RFF vehicles and aircraft (see Paragraph 34, Acoustics).

b. Alarms. AC 150/5210-7B, Aircraft Fire and Rescue Communications, provides guidance for planning and implementing fire station alarm systems. Other recommendations follow.

(1) The alarm may be sounded by chimes or gongs located throughout the entire station and any satellite stations. Chimes are recommended since they usually cause less stress than gongs.

(2) An audible alarm anywhere auxiliary firefighters may be employed is recommended, especially at airports with "dual function" personnel or auxiliary firefighters. Alarm sounds should be different from any other bell or alarm that auxiliary firefighters might hear and loud enough to be heard above normal workplace noise levels and wind conditions.

(3) Functional alarm room controls, such as signals and alarms, should be compact, orderly, and conveniently located. All personnel, including personnel confined to a wheelchair, should have no trouble reaching and operating all alarm room controls.

c. Communications. AC 150/5210-7B, Aircraft Fire and Rescue Communications, provides guidance for planning airport communication systems for airport RFF services. One important factor that affects the design of station communication systems is whether there is to be one or a series of airport fire stations. If more than one, a designation of one as the main station and the other(s) as the satellite(s) should be made. It is essential to differentiate between the minimum requirements needed at each station and those commonly needed at both.

10. FIRE DEPARTMENT OFFICE. THE STANDARD ROOM SIZE FOR ADMINISTRATIVE FUNCTIONS IS AT LEAST 125 SQUARE FEET (11.6 SQUARE METERS) FOR ALL AIRPORT INDICES. An additional 40 square feet (3.7 square meters) for storing files, records, and a work space for the fire chief may be included. The Fire Department Office, if a part of the watch/alarm room, should be a distinct area. Lavatory facilities should be nearby.

11. WORKSHOP. The workshop is an area for performing routine maintenance on the aircraft RFF vehicles and other station equipment.

a. Location. The workshop may be located either in a separate room adjacent to the vehicle room or a space designated in the vehicle room for a workbench and tool storage.

b. Features. The workshop should have:

(1) An intercom and alarm speaker that are easily accessible.

(2) Electrical outlets, one of which is at least 30 amps.

(3) Hot and cold water sources nearby for clean-up.

(4) A source of compressed air.

(5) An approved receptacle for disposal of greasy rags.

(6) A cabinet, designed in accordance with the standards of the National Board of Fire Underwriters Code 30 and in compliance with OSHA regulation 1910.106, for storing paints, greases, oils, and solvents.

(7) An adequate complement of mechanics tools (e.g., wrenches, socket sets, screwdrivers, pliers, hammers, chisels, rulers, and reamer).

(8) A first-aid kit and any necessary protective gear, such as goggles, earplugs, etc.

12. HOSE-DRYING FACILITIES. If hose-drying facilities are needed to support inservice aircraft RFF vehicles, they should be constructed near the rear of the hose-carrying vehicle to facilitate removal and replacement. If hose-drying facilities must be placed in a separate room, rollers should be installed around doorway edges to facilitate moving hoses from one room to another.

a. Mechanical Dryers. Mechanical hose-drying machines are frequently the most efficient means of drying hoses. A hose table and a rack near the dryer should be included to load, unload, and store hoses.

b. Hose Towers/Room. Hose towers/rooms can be either vertical or horizontal. A vertical tower occupies less floor space, usually an 8-foot square (2.4-meter square), but hanging and removing hoses is more dangerous. A horizontal room is safer but requires considerably more floor space. In either case, a floor drain to catch runoff water and a ventilating fan to provide adequate air exchange is recommended. Effective hose drainage is achieved in horizontal towers when hoses resting on racks are parallel to the room's sloped floor. A recommended slope is 3/4 inch per linear foot (6.25 cm per linear meter).

13. VEHICLE FUELING AREA. Unless vehicle fuel service is provided elsewhere on the airport, an area adjacent to the apron where vehicles can be easily positioned next to a fuel pump should be provided. The vehicle fueling area should be located to one side of the apron. Fueling hoses should be long enough to reach a vehicle's fueling connection. The dispensing pump(s) should be adequately protected against physical damage. One means of protecting fueling pumps is by placing them on a raised platform. For operational safety, the pumps should be fitted with remote shut-offs and be color coded to distinguish different types and grades of fuel. Fuel storage tanks must meet specific Environmental Protection Agency (EPA) requirements. Installation of both underground and aboveground storage tanks should observe approved design, fabrication, and installation practices; for example, API Publication 1615-79, Installation of Underground Petroleum Storage Systems; API Standard 2000-82, Venting Atmospheric and Low Pressure Storage Tanks; API Specification 12B, Specification for Bolted Tanks for Storage of Petroleum Liquids, (supplement 1-1982, supp 2-1985); American Society of Mechanical Engineers (ASME), Boiler and Pressure Vessel Code, 1983 edition; Underwriter's (UL) 58-76, Standards for Steel Underground Tanks for Flammable and Combustible Liquids; UL 142-81, Standards for Steel Aboveground Tanks for Flammable and Combustible Liquids; UL 1316-83, Standards for Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, etc.

14. DAY ROOM. The day room provides a place where personnel can relax while on a break. It may be a separate area, a section of the training room, or a part of the dining area. **THE STANDARD ROOM SIZE IS AT LEAST 10 SQUARE FEET (1 SQUARE METER) FOR EACH FIREFIGHTER PER SHIFT.**

15. DORMITORIES. At airport fire stations that operate "overnight" shifts, dormitory accommodations should be provided for firefighters to sleep.

a. Location and Capacity. Dormitories should be located on the ground floor, adjacent to the locker and lavatory area, and have direct access to the vehicle room. Ground floor dormitories are more easily used for emergency first aid stations since they are more accessible to incoming ambulances. If dormitories are

located on the second floor, second floor lavatory facilities should be provided. The dormitory area should be large enough to accommodate one bunk per each firefighter per duty shift. Bunk areas should be approximately 70 square feet (6.5 sq m) per firefighter. A separate dormitory of 180 square feet (16.7 sq m) should be provided to accommodate up to two officers per shift.

b. Features.

(1) The dormitory should be designed to minimize the stress personnel experience upon waking up from a sound sleep when responding to an emergency. For example, station and dormitory lights are often designed to turn on instantly to full intensity when an alarm goes off. Instant activation of such dormitory lights creates unnecessary stress. A better alternative is to use night lights placed approximately 12-18 inches (30-46 cm) above the floor. They may be controlled by a dimmer connected to the alarm circuit which gradually increases intensity during an alarm.

(2) Wall, floor, and locker materials should be chosen for noise attenuation. Lockers should be located outside the dormitory to reduce sleeping area noise.

(3) There should be a closet for storing linens, blankets, and cleaning equipment either in or adjacent to the dormitory.

(4) There should be a dormitory clock and at least one extension of the intercom installed in each dormitory. An extension of a highly visible and easily accessible crash phone should be available in both the crew's and officer's quarters.

(5) Bunk height should allow firefighters to swing their legs out of bed and directly step into turnout boots and pants. Bunk placement should be away from heating and cooling drafts.

(6) Each dormitory should have fire exit(s) as specified by the appropriate building code. If acceptable, fire escape windows that can be opened only from the inside may serve as exits for dormitories on the ground level.

(7) Each bunk should have a coat hook or rod nearby for hanging clothes and a convenient electrical outlet.

(8) If space and resources permit, the dormitory should be designed to provide privacy. Privacy may be achieved by semi-private areas for 2, 3, or 4 firefighters by placing transportable partitions between bunks. Another dormitory arrangement that offers privacy and bed ownership is 2- or 3-bed private sleeping areas where beds are assigned to different shifts.

16. LOCKER ROOM. The locker room should be adjacent to the dormitory and lavatory areas. The locker room should provide easy access to the lockers with at least 9 square feet (1 square meter) of clear area centered in front of the locker for each firefighter. Since clearance is a function of the number of firefighters per shift, assigning alternate lockers to personnel on the same shift will reduce

the overall locker room size. It is recommended that the locker is equipped with a half-shelf and hooks or a coat hanger rod and have dimensions of at least 18 inches (46 cm) wide, 24 inches (61 cm) deep, and 78 inches (198 cm) high.

17. LAVATORIES.

a. Accommodations. Separate, well-heated and ventilated facilities for male and female service personnel should be provided. At least one lavatory facility should accommodate handicapped individuals.

b. Features.

(1) The number of toilets, urinals, sinks, and showers for each lavatory is based on applicable building codes. The minimum facilities recommended are: airport indices A and B, one toilet, urinal, sink, and shower; airport indices C, D, and E, two of each of the above items. Partitions should be placed between urinals and toilets for privacy. Any lavatory intended for use by women should have a dispenser and a receptacle for sanitary napkins.

(2) Individual shower stall dimensions should be at least 3½ feet by 3½ feet (107 cm by 107 cm).

(3) Hooks for articles of clothing and towels should be located near showers and sinks, but far enough away so articles remain dry.

(4) Each sink should have an electrical outlet that is protected by a ground fault interrupter circuit device.

(5) Ceilings should be of water-resistant materials, such as gypsum board or plaster, walls of ceramic tile, and floors of nonslip surfaces.

(6) Extra items should include a wall clock and an installed mirror on the wall that is large enough to be used simultaneously by two or three individuals.

18. KITCHEN/DINING ROOM.

a. Design.

(1) Work Triangle. In kitchen design, the refrigerator, sink, and stove form a "work triangle." Greater kitchen efficiency is achieved by keeping the sides of this "work triangle" small. Side lengths should be 5 to 10 feet (1.5 to 3.0 m) between any two of the three appliances. Kitchens should also be designed to keep noncooking personnel from crossing through the work triangle. Additionally, there should be no permanent objects that may obstruct firefighters responding to an alarm.

(2) Emergency Exit. THE KITCHEN SHALL HAVE A DOORWAY LEADING TO THE EXTERIOR OF THE STATION.

(3) Modes of Use. The design should consider the different modes of use. For example, one shift may rotate kitchen duties among the firefighters, one or two individuals responsible for each meal; another shift may require each firefighter to prepare his/her own meal.

b. Size. THE STANDARD DINING AREA IS EQUAL TO THE NUMBER OF PLACE SETTINGS TO SEAT ONE FULL SHIFT OF FIREFIGHTING PERSONNEL ALLOWING AT LEAST 20 SQUARE FEET (1.9 SQUARE METERS) PER PERSON.

c. Facilities.

(1) Stove. All stoves should be provided with an automatic energy shut-off device that is connected to the alarm. For gas stoves, a manual reset should be located near the stove; thus whoever restarts the stove will first have to check it. For conservation and safety, gas ovens, broilers, and burners should have pilotless electric ignitions with an automatic gas valve. Gas stoves should be placed far enough away from doors and windows or be shielded to reduce the likelihood of drafts blowing out a gas jet. The space between the heating elements or burners should accommodate a large 3-gallon (11.5-liter) pot on one burner without interfering with a pot on the adjacent one. Sufficient space is particularly important at stations using "community" cooking.

(2) Sink. A stainless double bowl steel sink fitted with a heavy duty garbage disposal is recommended.

(3) Cabinets. Built-in cabinets or a pantry for storing canned and dry goods and other normal kitchen staples should be part of the kitchen design.

(4) Ice Makers. If the kitchen or station design includes a commercial ice maker, a water drain that is connected to the station wastewater system should be located underneath.

19. TRAINING ROOM. A specific area should serve for training purposes. The training area need not be a separate, enclosed room; it may be part of a conference room, a dining room, or even a day room. Regardless of location, space for a blackboard, projection screen, bulletin board, charts, maps, and other necessary training aids should be provided. The room should also have adequate secured storage space for instructional materials, audio-visual training aids, equipment, and supplies. IF A SEPARATE TRAINING ROOM IS BUILT, THE STANDARD IS AT LEAST 30 SQUARE FEET (2.8 SQUARE METERS) PER FIREFIGHTER PER SHIFT.

20. MECHANICAL ROOM. The mechanical room usually houses the major components of the heating, ventilating, and air conditioning systems. The room itself should be heated and cooled. Sufficient space should be provided around each system for convenient, safe access for servicing. Floor finishes should be resistant to water, oil, and grease. In addition, the mechanical room may house the main connections for electricity, gas, water, and telephones. If so, the room should be designed so as not to create a shock hazard (see Paragraph 47, Hazards and Safety). Electrical panels should be carefully located so that individuals, while servicing or checking panels, are not electrically grounded. Acoustic attenuation measures should be incorporated in the room's structure (see Paragraph 36 Sound Control Solutions.)

21. STORAGE ROOM. The storage room provides space for storing a reserved supply of foam concentrate, other extinguishing agents, first aid supplies, and department supplies. Its preferred location is adjacent to the vehicle room. STANDARD ROOM SIZES ARE AT LEAST: AIRPORT INDEX A, 200 SQUARE FEET (18.5 SQUARE METERS); AIRPORT INDEX B, 300 SQUARE FEET (27.9 SQUARE METERS); AIRPORT INDICES C AND D, 400 SQUARE FEET (37.2 SQUARE METERS); AND AIRPORT INDEX E, 500 SQUARE FEET (46.5 SQUARE METERS). If foam concentrate containers are to be stored in the storage room, the type (drums or barrels) and quantity should be determined and shelves designed to accommodate the containers. A storage room floor drain is recommended. To facilitate delivery of the above supplies, a second means of access and/or extra wide doors may be desirable. In all cases, the minimum door opening should be 6 feet (1.8 m) wide.

22. STUDY ROOM. The study room is a small room or area designated as a quiet space for study. It should have a table, a few chairs, space for writing, and shelf or storage space for fire service manuals and other pertinent documents. The preferred location is adjacent to or near the dormitory area. Noise sources should be reduced or controlled.

23. BREATHING APPARATUS REFILLING AREA. Depending on local procedures, a special room or an area of a room where Self-Contained Breathing Apparatus (SCBA) can be refilled may be needed. If provided, the area should have:

a. A degree of air purity that meets or exceeds the standards of the Compressed Gas Association Specification G-7.1 for Grade D Breathing Air of the Occupational Safety and Health Act (OSHA).

b. An air compressor specifically designed to provide breathing quality compressed air for filling SCBA.

c. A sink/water tank where air tanks can be submerged to cool during refilling.

d. A 230 VAC 1-phase or 230 VAC/460 VAC 3-phase receptacle, depending on type of air compressor.

e. Storage tanks that meet or exceed section VIII of the American Society of Mechanical Engineers (ASME) Code for Unfired Pressure Vessels if a cascade system is used. It should be noted that storage vessels rated by the U.S. Department of Transportation and the Interstate Commerce Commission do not meet those standards and are unacceptable.

f. All major components and accessories clearly identified with permanent name plates stating make, model, serial number, capacities, pressures, voltages, currents, and any other pertinent information.

g. Tags and warning labels affixed to equipment for safety and ease in the operation and adjustment of valves, switches, and controls.

24. PARKING AREA. The recommended minimum parking area is one space per person per duty shift. In addition, a parking area for visitors should be provided. Ideally, the parking area would accommodate two duty shifts, thereby eliminating delays when shifts change or when all firefighters are summoned during an airport emergency. The area should be located so not to obstruct firefighting operations; for instance, located away from the apron area, vehicle room doors, and any firefighting equipment stored outside the station. **HANDICAPPED REQUIREMENTS SUCH AS CURB CUTS, SIDEWALK RAMPS, AND DESIGNATED PARKING SPACES SHALL BE PROVIDED.** Furthermore, the parking area should be secured and located to protect against vandalism.

25. JANITOR CLOSET. A closet for storage of station maintenance equipment (e.g., vacuum cleaners, mops, and buckets) and cleaning supplies should be provided.

a. Size and Location. **THE STANDARD JANITOR CLOSET AREA IS AT LEAST 30 SQUARE FEET (2.8 SQUARE METERS) WITH THE CEILING AT LEAST 8 FEET (2.4 M) HIGH.** There should be space for storage racks, shelves, cabinets, mop rack, a janitor's sink, electrical light switch, and wall mounted convenience outlets. The recommended location is near the lavatory areas and/or the mechanical area. More than one closet may be necessary, depending on the size of the station. Avoid locating janitor closets adjacent to carpeted areas.

b. Construction. Selected materials should be nonhazardous (e.g., nonasbestos), durable, and easy to clean. The ceiling finish may be exposed construction; walls may be gypsum board with ceramic tile, masonry, or concrete; and floors may be of concrete or tile.

26. LAUNDRY FACILITIES. Laundry equipment of laundromat quality is cost-effective at some airports. If station personnel use a large number of rags, it may actually be cost-effective to wash the rags and reuse them rather than to purchase new ones.

27. EXERCISE FACILITIES. Proper exercise encourages physical fitness and mental alertness. Firefighter professional development standards and many employment criteria specify minimum physical fitness standards for emergency personnel. Thus, an exercise area may be included. Such an area should be large enough to accommodate 50 percent of a shift and equipment.

a. Interior Exercise Room. A typical exercise facility may include the following items: multi-station pin sectorized gym unit, ergometer bike, rowing machine, mats for sit-ups, aerobics, drop weights, abdominal board, Roman chair for the abdominal board and lower back exercises, treadmill, and jump ropes. Free weights are not recommended as a second person needs to be present when free weights are in use.

b. Exterior Exercise Area. An outdoor obstacle course may be a suitable facility adjacent to the station. Some of the features may include: log hop, stretch bucks, Achilles stretch, sit-up/push-up mats, horizontal ladder, balance beam, vertical ladder, cargo net, chin-up bar, and parallel bars.

28. PATIO. Some airport sponsors consider a patio a cost-effective station accessory that contributes significantly to employee morale. If provided, a patio should be protected from wind, excessive noise, aircraft backwash, airborne debris, and located to offer privacy. If enclosed, a brick or concrete wall of 7 to 8 feet (2.1 to 2.4 m) high surrounding the area will suffice. ALL ALARMS, PHONES, AND INTERCOM ARE REQUIRED TO BE AUDIBLE BY THE FIREFIGHTERS ON A PATIO. ALSO, A PATIO SHALL HAVE EASY ACCESS TO THE VEHICLE ROOM.

29. STATION STORE. A station store is a convenience that personnel appreciate, a place where they can buy provisions like candy, soft drinks, coffee, and hot and cold snacks. The "store" can take several forms: a counter, a locker, or a small commercial freezer where provisions are stored, or vending machines. Some stations combine forms; for example, a station might have vending machines and a counter. Designers should consider setting aside space for the station store, either as an alcove or in a corner of a room. They should also provide storage containers with locks.

CHAPTER 4. STATION SYSTEMS

30. FIRE SAFETY. Fire safety in station design can be achieved through proper design, use of fire resistant materials, and employing fire safety technology. Construction materials should be as fire protected and fire-resistant as possible, preferably noncombustible. Second floor dormitories should receive special emphasis. Stations built of concrete masonry should observe the National Concrete Masonry Association (NCMA) practices, e.g., NCMA-TEK 46, Fire Safe Concrete Masonry Construction, NCMA-TEK 80 A, Fire Safe Apartment Construction with Concrete Masonry, NCMA-TEK 35 B, Fire Safety With Concrete Masonry, NCMA-TEK 128, Steel Column Fire Protection. All pipe passages through fire-resistant construction should not exceed $\frac{1}{2}$ -inch (1.25 cm) gaps between the pipe and sleeve. The remaining interior gap can be filled with an appropriate noncombustible filler and sealed on both sides of the wall by metal escutcheons. Materials enclosing the vehicle room should have a minimum of a 2-hour fire resistance rating. Openings between the vehicle room and dormitories should be provided with either a vestibule or double acting double doors. Stations located in isolated areas should have an accessible fire hydrant. Other fire safety considerations are: smoke/fire detectors; location and illumination of exit signs; fire doors; sprinkler system (see National Fire Protection Association (NFPA) 13-1985, Standards for the Installation of Sprinkler Systems); fire escape stairs (where applicable); emergency exit windows; and a sufficient number of strategically located fire extinguishers that contain the appropriate extinguishing agent for the type of materials found in the area (see NFPA 10-1984, Standards for Portable Fire Extinguishers).

31. CIRCULATION, DOORS, AND WINDOWS.

a. Circulation. Circulation of service personnel and equipment should be safe, convenient, and rapid under both normal and emergency conditions. Careful consideration should be placed on vertical traffic circulation. STANDARD WIDTH OF ALL HALLS AND PATHWAYS LEADING TO AND FROM THE VEHICLE ROOM IS AT LEAST 4 FEET (1.2 M). STANDARD WIDTH OF CORRIDORS THAT CONNECT AREAS SERVED BY LARGE NUMBERS OF OPERATIONS/PERSONNEL IS AT LEAST 6 FEET (1.8 M). For personnel safety and quick emergency responses, avoid protruding obstructions such as water fountains, ash trays, and fire extinguishers. It is recommended that stairs leading to second floor areas be of straight-line design, without landings, of a minimum width of 6 feet (1.8 m) and with safety treads. Circulation and more effective station operations are further increased by using the smallest permissible number of doors and corridors.

b. Doors. Entrances, exits, and interior doors should be selected for smooth traffic flows, safety, and for the expected traffic volumes (wear). Specific door design details are location, size, and direction of door swings. THE STANDARD FOR THE SWING OF DOORS OPENING INTO THE VEHICLE ROOM IS AT LEAST 175° WITH VESTIBULE DOORS OPENING AS FAR AS POSSIBLE. All exterior doors should be weather-tight and either solid-core or of a high noise reduction value.

(1) Effective doors are readily accessible, simple to locate and operate in the dark, quick opening (3 seconds or less), operable with 10 to 30 pounds (44 to 133 newtons) of force, and not of themselves or in operation a safety hazard.

(2) The minimum width of all doors in rooms that more than four fire-fighters may use at any one time, e.g., the lavatory, locker room, and kitchen, is 42 inches (107 cm) wide. All doors should accommodate wheelchairs. For wheelchair clearances see American National Standard Institute (ANSI) A117.1-1980, Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

(3) All doors in rooms that more than one firefighter may occupy should open towards the vehicle room.

(4) Sliding doors should be avoided except for storage and utility rooms.

(5) Exit doors and doors leading to exit passageways should be so designed and arranged to be clearly recognizable and readily accessible at all times.

(6) Doors to the dining area, locker room, lavatory, and dormitory should feature only door closers (if needed) and push-and-pull plates (no latching hardware).

c. Windows. The minimum glass areas should be 10 percent of the floor area of each room; 20 percent being recommended. Placement should be as high in the wall as possible to lengthen the depth of light penetration. Use of weather stripping and storm sash is one means of reducing heat loss, condensation, and particle infiltration and increasing noise attenuation.

32. ELECTRICAL SYSTEM. The electrical system design should be based on the latest edition of the National Electrical Code or applicable local codes or ordinances. Ground fault circuit breakers should be used where personnel use an electric outlet near a water source such as bathrooms, kitchens, or vehicle room. A SOURCE OF STANDBY POWER SHALL BE PROVIDED TO OPERATE THE ESSENTIAL COMPONENTS OF THE STATION, I.E., THE ALARM CIRCUIT, COMMUNICATION EQUIPMENT, AND SELECTED OUTLETS IN AT LEAST THE VEHICLE ROOM AND ALARM ROOM.

33. LIGHTING. Recommended levels of lighting that take into account energy conservation and functional tasks may be found in the latest edition of the IES, "IES Lighting Handbook". AC 150/5360-11, Energy Conservation For Airport Buildings, provides recommendations for reducing existing and new lighting levels, improving the efficiency of lamps and fixtures, and avoiding energy waste in lighting design and installation.

a. Alarm Lights. All lights that illuminate the pathways to the vehicle room and that illuminate the apron driveway should turn on automatically when an alarm rings. Alarm lights need not operate on a separate circuit or system; they may operate through 3-way switches. All alarm lights should be connected to a backup power source or be backed up by separate emergency lighting.

b. Parking Lot and Yard Lights. Exterior lights should:

(1) Be shielded to prevent glare in the air traffic control tower (ATCT) line of sight and aircraft operation areas.

(2) Use high efficacy lamps.

- (3) Use time clocks or photoelectric switches to reduce energy costs.
- (4) Cover areas subject to possible vandalism.
- (5) Comply with the latest IES recommended practices.

34. ACOUSTICS. An acceptable acoustic environment is one which will not cause auditory injury, interfere with voice or any other communications, cause stress fatigue, or in any other way degrade the overall aircraft RFF service. To be acceptable, workspace noise should be reduced to levels that permit necessary direct person-to-person and telephone communication. Criteria for workspaces are defined by the A-sound level decibel, dB(A). To achieve an acceptable noise level, designers should provide for the following.

a. Small Office Spaces/Special Areas. Areas requiring fast, accurate, and direct communication should not exceed 45 dB(A). Examples: watch/alarm room, offices, dormitories, conference/training room, study room.

b. Large Workspaces. Areas requiring very clear and frequent telephone communications or requiring occasional direct voice communication at distances up to 15 feet (4.57 meters) should not exceed 55 dB(A). Examples: kitchen, lavatories, eating areas, locker rooms.

c. Operational Areas. Areas requiring frequent telephone communications or frequent voice communication at distances up to 5 feet (1.5 meters) should not exceed 65 dB(A). Examples: workshops, laundry areas, maintenance shops.

d. General Workspaces. Areas requiring occasional telephone communications or occasional person-to-person communication at a distances up to 5 feet (1.5) should not exceed 75 dB(A). Examples: vehicle room, hose drying room, mechanical room.

35. SOUND TRANSMISSIONS. Control of sound transmissions within and between rooms needs to be analyzed for an acceptable acoustic room environment. Both areas of investigation have unique and interlinking acoustic factors that influence the sound level of a room. If the room environment is to be conducive to good hearing, the desired room sound should be uniformly distributed, sufficiently loud to be heard, and transmitted within, as much as possible, a quiet background.

a. Sound Transmission Within a Room. Factors include:

(1) Reflection and Absorption. Generally sound reflection occurs at the boundaries of the room (e.g., ceiling, floors, walls). The amount of reflection is dependent on the amount of sound absorption that takes place at each boundary. For example, concrete and other hard surfaces have little absorption while fabric has the most absorption.

(2) Background Noise. These are the composite sound effects from many sources that either completely cover up or, at least to some extent, obscure the desired room sound (of a lower dB(A)). Since background noise may be either above or below the desired transmitted sound's dB(A) level, room design should control the background noise level to the extent necessary through effective sound reduction or attenuation.

(3) Miscellaneous Factors. These include echoing and undesirable reflection sounds such as structure-borne, air-borne, and fluttering sounds.

b. Sound Transmission Between Rooms. Factors include:

(1) Air-Borne Transmission. This results when impacting sound sources act directly on one side of a barrier wall, such as jet engine noise, to cause the reproduction of air-borne sound transmission on the other side.

(2) Structure-Borne Transmission. This results when sound waves are transmitted within the station structure by either air-borne or direct impacting sound sources. Common transmission paths are the structure itself or any continuous rigid element of the station, as piping networks, conduits, air handling systems, etc. Rigidly secured mechanical equipment can generate high level sound waves that reverberate in adjacent spaces.

(3) Background Noise. See paragraph 35(a)(2).

(4) Barrier Transmission Losses. Room to room noise reduction usually occurs between the "source" room and a "receiving" room. The existing sound-intensity level difference or sound-pressure level (SPL) between rooms is dependent on the barrier's material transmission loss, common barrier surface area, receiving room absorption rate, and effects of background noise levels as illustrated in figure 8.

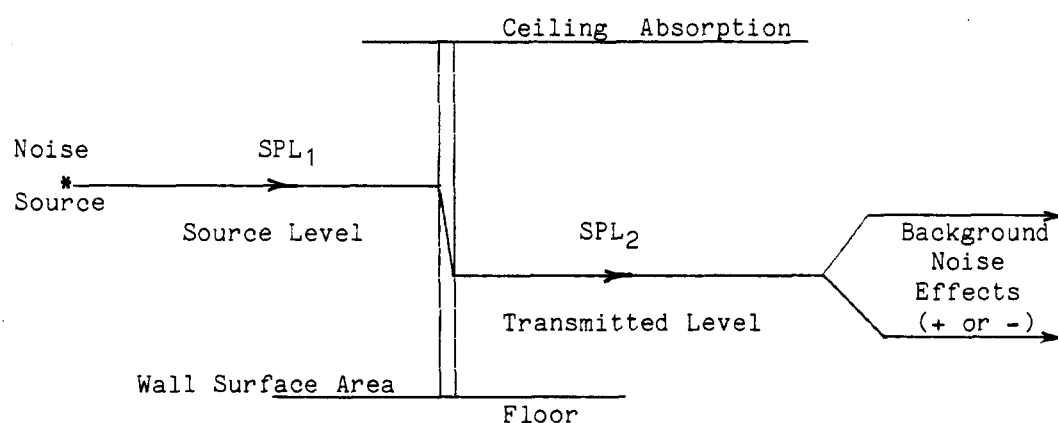


Figure 8. Simple case of room-to-room air-borne sound transmission

(5) Vibration Noises. These noises are often generated by mechanical equipment, air-handling systems, etc., that produce intrusive air-borne and structure-borne sounds.

(6) Flanking Paths. Sound transmission paths that bypass common room barriers via the connecting floor, wall, ceiling structures, or through openings around or in the barrier are termed flanking paths. Common flanking paths such as openings above walls, and poor acoustic design layouts as back-to-back light switches and electrical outlet boxes and rooms with adjacent doors separated by a common wall are illustrated in figure 9.

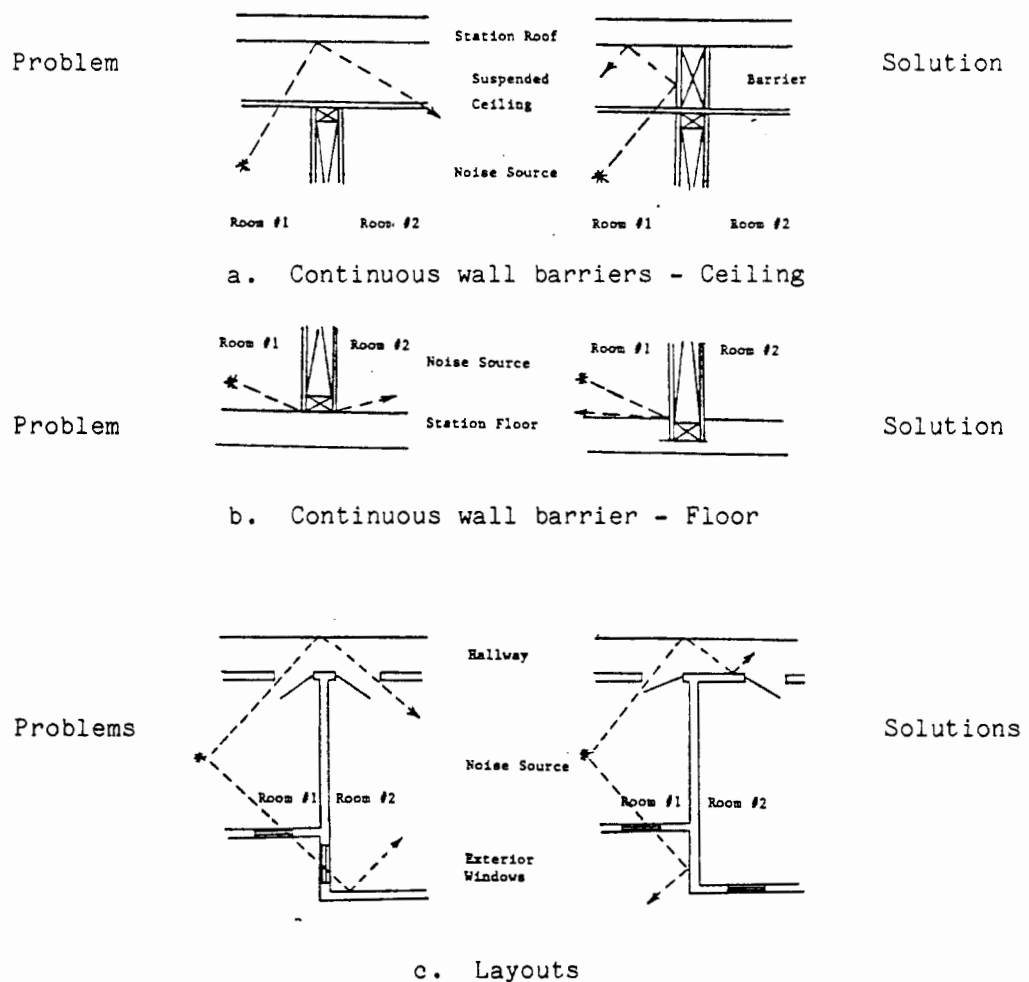


Figure 9. Common flanking paths with solutions

(7) Construction Leakage Paths. Closely associated to flanking paths are the unwanted sounds transmitted by common construction points of leakage, such as the crevices around doors, openings around the perimeter of piping networks, and air handling systems that penetrate wall barriers (see figure 10).

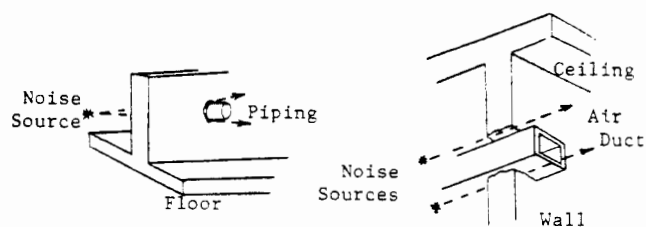


Figure 10. Common construction noise leakage paths

36. SOUND CONTROL SOLUTIONS. Acceptable solutions to sound control problems are based on eliminating the source of the sound, protecting the receiver from the sound, and modifying or treating the transmission paths. The most effective approach is the elimination of a sound source. Other approaches include the installation of sound absorption or sound reflection materials and/or sound isolating materials, and proper station design and construction detailing.

a. Eliminating the Source of the Sound. Even though this is the most effective means of noise control, it may in some cases be unrealistic; for instance, eliminating aircraft engine noise.

b. Sound-Absorbing Materials. It is relatively easy in any room to obtain between 5 and 10 dB(A) of noise reduction by installing some type of sound-absorbing material around the sound source and receiver. Carpets, upholstered furniture, and other room furnishings assist in reducing the levels of undesirable noises. Where carpeting is not feasible, sound-absorbing materials, such as special ceiling assemblies and/or wall treatment, should be used. Acoustic materials with high sound coefficients should be provided as necessary in the construction of floors, walls, and ceiling to effect the desired sound control. Very thick layers of sound-absorbing materials are good for reducing low-frequency sounds, while thin layers are more effective at higher frequencies. The more appropriate the sound-absorbing barrier, the greater the sound transmission control. Control of reverberation, echoes, and other types of sound reflections can be achieved through the proper amount of sound-absorbing material and properly configured and proportioned rooms. It should be emphasized that the principal use of sound-absorbing materials is for the control of sounds "within" a room and not for the control of sound transmissions between rooms. Such material usually makes no significant differences in lowering outside sound transmissions. Precaution should be observed for interior applications of acoustic materials to assure that there are no reductions in the quality of its porous material by repeated paintings or abuse. Exterior painting of station's concrete, block, brick surfaces, etc., is recommended as a means of noise attenuation.

c. Sound Isolating. When a greater order of magnitude of sound reduction is desired, isolating the source of the sound is a more effective approach than absorption techniques alone. Vibration and structure-borne noises are two such areas that may benefit by this noise control technique.

(1) Vibration Noises. Effective noise damping of rigidly secured mechanical equipment, supply and return ventilation ducts, etc., can be achieved by properly locating such items, using resilient materials or special damping systems. Recommended vibration noise control procedures are found in ASHRAE.

(2) Structure-Borne Noises. Careful structural design to isolate direct vibration-inducing noise sources and to avoid the bridging of resilient construction is extremely important in the prevention of such sound transmissions problems. Additionally, designs should consider the use of discontinuous sound transmission paths.

d. Proper Design and Construction Detailing.

(1) Flanking paths. Excessive noise can be attenuated by the physical design and layout of station rooms and workspaces. Special attention should be given to:

(i) Doors and Windows. Related doors and windows that are widely separated and properly sealed produce high-transmission losses. Separately, the sound insulation value of doors and windows can be increased as follows.

(A) Doors should be staggered in corridors or between rooms. Thick solid-core doors complete with soft, resilient, perimeter gaskets and threshold seals should be specified instead of hollow core doors for greater noise reduction. The installation of all prefabricated door kits should be checked to insure they are properly sealed.

(B) Windows are the weakest acoustical barrier in the exterior wall of a station. Ordinary locked, double-hung windows generally provide an average noise reduction of about 18 dB(A). This value can be improved by installing storm windows. Triple-paned or double-paned windows of tested high acoustic attenuation value (Sound Transmission Class (STC) range 29 - 47) can increase this value further. In all cases, proper window installation and window sealing is critical. Since the type of sealant is important, the specified sealing materials should not shrink or pull away.

(ii) Ceilings. Suspended ceilings with partial partition arrangements (if used) are high transmitters of sound. Therefore, partition construction should be beyond the level of the suspended ceiling to the underside of the structure above. Another solution that retains the flexibility of this type of design is a horizontal barrier at the level of the suspended ceiling.

(iii) Floors. Rooms that could be expected to have high levels of air-borne and structure-borne sounds from adjacent rooms, such as those adjacent to a mechanical room or the vehicle room, should avoid lighter weight floor construction or use high-transmission loss barriers in such openings.

37. SELECTION OF ACOUSTICAL MATERIALS. There are several broad categories of acoustic materials available each, with specific purposes. For whatever reason a particular acoustical material is selected, quality of workmanship is critical. Good materials installed with air gaps or air leaks greatly reduce acoustic attenuation values. Quality control of this type of construction and installation should be carefully observed.

38. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) SYSTEM. In HVAC system design, the focus should be on the total system and its energy efficiency. The HVAC system design should accommodate the range of inside and outside design conditions.

a. Inside Design Conditions. The design conditions that should be determined are the dry bulb (DB) temperature, relative humidity (RH), and the rate of interior air movement. Calculations should be made for the occupied spaces under average conditions 3 to 5 feet (1 to 1.5 m) above the floor line. See the latest edition of the American Society of Heating, Refrigerating, and Air Conditioning Engineers

(ASHRAE) "Handbook of Fundamentals" for DB values. Internal DB should be maintained at a temperature above 50°F (10°C). Sufficient capacity should be provided to maintain an effective indoor temperature (figure 11) not less than 65°F (18°C) unless otherwise dictated by unusual types of work. For a uniform room temperature, the air at floor level and at the head level should not differ by more than 10°F (5.5°C). Acceptable RH values should range from a minimum of 20 percent to a maximum of 60 percent where summer values are 45 percent to 55 percent and winter values (lessen the possibility of condensation) are 30 percent to 35 percent.

Note: To use nomograph, draw straight line between dry-bulb temperature (A) and wet-bulb temperature (B). Effective temperature (ET) is indicated where this straight line crosses the appropriate value for a velocity of air. (In this example, ET is 69°F for DB of 76°F, WB of 62°F and air velocity of 100 ft/min.)

To convert to Centigrade: $^{\circ}\text{C} = \frac{5}{9} (^{\circ}\text{F} - 32)$.

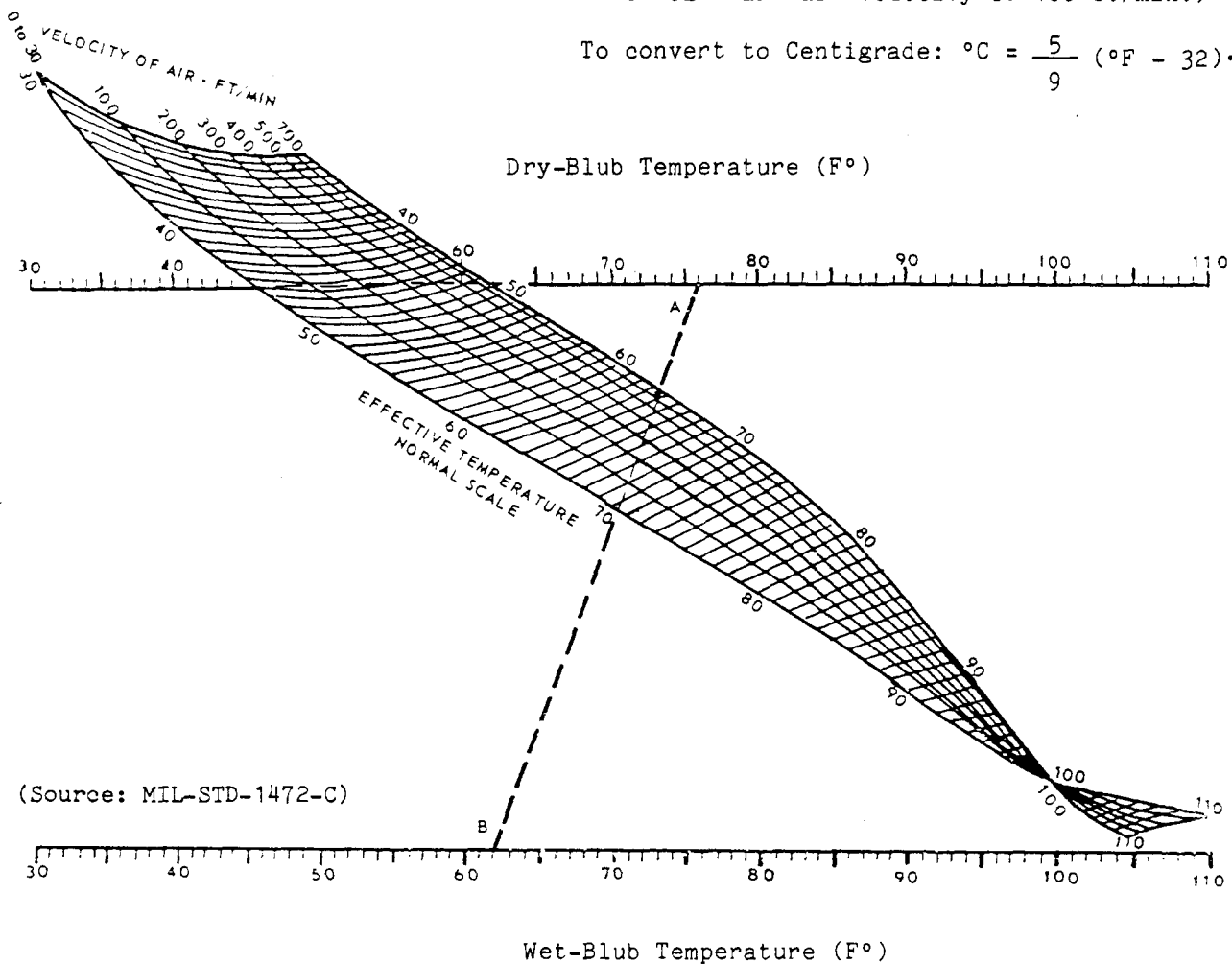


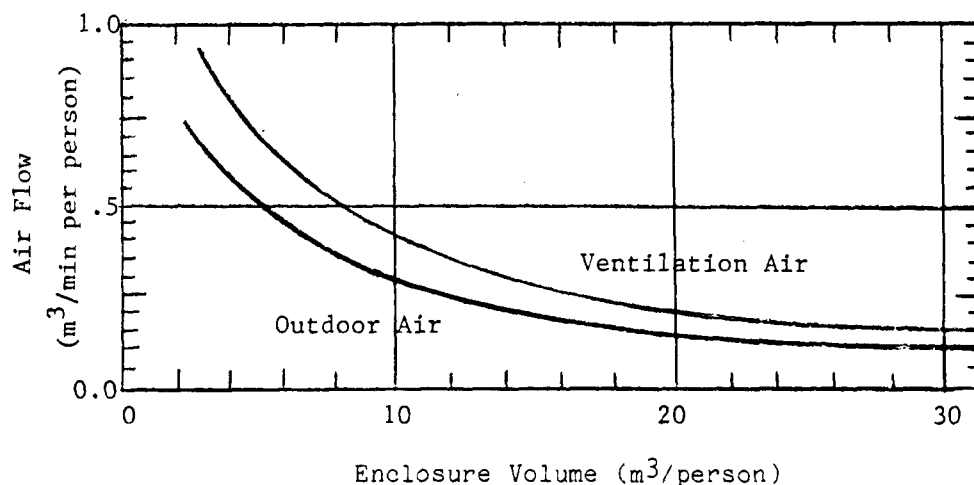
Figure 11. Effective temperatures

b. Improved HVAC Efficiency. Energy can be saved through improved HVAC operations, design of lower flow resistance duct and piping systems, and improved heating/air conditioning units. AC 150/5360-11, Energy Conservation For Airport Buildings, provides guidance on such efficiency improvements.

39. VENTILATION. Adequate ventilation in any personnel enclosure can be attained by the introduction of fresh air by either natural or mechanical means. Mechanical systems are preferred over natural processes because they are more reliable and permit the ability to maintain specific design air-changes per hour.

a. Mechanical Ventilation. This can be achieved by a supply system, exhaust system, or a combination of both. The design of a mechanical ventilation system, as well as any vents, should consider techniques to achieve maximum noise attenuation. Both natural and mechanical methods, should provide air from the outside to replace stale and vitiated air, smoke and odors, chemical and vehicle fumes, and to control humidity, temperatures, and condensation. Air intakes for ventilation systems should be located to minimize the introduction of contaminated air from sources such as exhaust pipes, exiting ventilated air, and aircraft exhaust fumes (aprons, terminal ramps).

b. Air-Changes per Hour. Numerous building codes and OSHA standards govern ventilation minimums (air-changes per hour). These values are based on the number of persons in a given space, type of activity, space volume, and generated heat and odors. If the enclosure volume is 150 ft³ (4.25 m³) or less per person, a recommended minimum value of 26.5 ft³ (0.75 m³) of ventilation air per minute per person should be introduced into the enclosure where approximately two-thirds, 17.5 ft³ (0.50 m³) is outside air. For larger enclosures the air supply per person should at least meet the air flow recommendations contained in figure 12.



(Source: MIL-STD-1472C)

Figure 12. Ventilation air quantities

40. AIR CONDITIONING. Depending on local weather conditions, air conditioning of part or of the entire station may be necessary. See AC 150/5360-11, Energy Conservation for Airport Buildings, for guidance on increasing the performance of an air conditioning system by changes to the mode of operation, operating conditions, and by observing routine maintenance and service procedures.

41. ROOM TEMPERATURES. Recommended minimum temperatures of some station rooms are shown in table 1.

Room	Temp °F	Temp °C
Watch/Alarm, Dining Area, Study Area	68	20
Dormitory	65	18
Vehicle room	55	13
Hose-drying room	55	13
Storage room	55	13
Lavatory and showers	70	21
Mechanical room	50	10

Table 1. Recommended minimum room temperatures

42. HEATING PLANTS. Properly designed heating systems provide: quick heat where needed; reduced temperature differentials between floor and ceiling; rapid circulation of air without objectionable draft; non-direct discharged air on personnel; and, uniform temperature distribution. Common heating systems are:

a. Hot-Water or Steam Heating. If used, avoid air pockets within the piping system by pitching the system so air will collect at venting points.

b. Forced Warm-Air Heating. Insulated ducts should be used for cost-effective heat distribution.

c. Space Radiant Heating.

d. Heat Pumps. Cost-effectiveness depends on geographic location.

e. Unit Heaters. These are best utilized for large areas such as the vehicle room or large storage areas. They should be placed at or near ceiling level.

f. Solar Heating. Solar heating systems provide both space heating and water heating. Limitations include availability of the sun's energy, its energy flux, hourly variations, and initial installation cost.

43. ENERGY CONSERVATION. The promotion of energy conservation while designing or remodeling a station is a primary means of "long term" energy cost savings. At some airports the central heating and cooling systems may be able to handle the requirements of the station. The airport sponsor, to determine whether using the excess capacity of the existing facilities is cost-effective, should determine the costs of modifying the system, identify the energy source, evaluate the long-term

availability of the source, and project the likely cost for several years. Normally, emergency standby equipment should be added to the station. The cost of standby equipment may offset the initial savings of using existing sources. For guidance and detailed information on promoting energy conservation in the design and operation of stations and for initiating energy conservation programs, see AC 150/5360-11, Energy Conservation for Airport Buildings. Stations built of masonry concrete should see National Concrete Masonry Association NCMA-TEK 58, Energy Conservation with Concrete Masonry and NCMA-TEK 82, Energy-Conscious Design for Buildings.

CHAPTER 5. OTHER STATION TOPICS

44. PROVISIONS FOR WOMEN FIREFIGHTERS. Women firefighters, if not presently employed, may be hired. Therefore, it is more cost-effective to plan for women personnel instead of accommodating them later through costly remodeling of the existing station. Several obvious issues are:

a. Adjustments to the height of certain station items, e.g., lavatory counters, built-in-shelves, cabinets, racks.

b. Adjustments to weight activated items, e.g., sliding pole doors.

45. PROVISIONS FOR PHYSICALLY HANDICAPPED SERVICE PERSONNEL. An accessible station for physically handicapped service personnel should be designed by noting appropriate sections of 49 Code of Federal Regulations, Part 27, Non-discrimination on the Basis of Handicap in Programs and Activities Receiving or Benefitting from Federal Financial Assistance. Other guidance can be found in American National Standard Institute (ANSI) A117.1-1980, Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People. Such design allows unrestrictive performance by such employees.

46. MAINTENANCE COST.

a. Station Materials. An important criterion in the selection of building materials is overall maintenance cost. Building material selected for maintenance and cleaning qualities will lower "long-term" costs of ownership more than the purchase of less expensive materials.

b. Design. Room design can contribute to reduced maintenance costs. Less maintenance is required by rooms and workspaces that are designed to be easy to clean, such as the use of stainless steel kitchen backsplashes and plastic laminates. Also, the design should exclude dust collecting alcoves and corners, unless they have a specific purpose, and difficult to clean decorative objects with moldings or trims that project.

47. HAZARDS AND SAFETY. Hazards should be eliminated wherever possible through accident prevention design. When this is not possible, personnel should be warned of a hazard by posted safety labels, signs, or audible devices. Safety features that meet established safety codes and regulations and applicable OSHA requirements should be included. Safety topics are:

a. Safety Labels and Signs.

(1) Conspicuous labels or signs should be placed adjacent to any equipment which presents a hazard to personnel, e.g., from high voltage, heat, toxic vapors, high pressure, or moving parts. For the type of hazard, design, color, lettering and placement of warning signs, see American National Standard Z 35.1-1972, Specifications for Accident Prevention Signs.

(2) The safe working capacity on hoists, lifts, jacks, and similar weight-bearing equipment should be indicated.

(3) Areas of operation or maintenance where special protective clothing, tools, or equipment are necessary, e.g., insulated or safety shoes, gloves, hard hats, ear or eye protection devices, should be specifically identified.

b. General Workspace Hazards.

(1) A hazard alerting device should be installed to provide a warning to personnel of impending or existing danger, e.g., toxic or asphyxiating gases, smoke, and fire.

(2) Stairs and treads should be provided with skid-resistant step treads.

(3) Workspaces should be designed free of obstructions which could cause injury to personnel, either through accidental contact with the obstruction or because the obstruction requires an awkward or dangerous body position. Avoid obstructions such as projecting drinking fountains, lighting fixtures, and heating devices in station corridors or other circulating areas.

(4) Warning placards, stairways, and all hazardous areas should be well illuminated.

c. Electrical Hazards.

(1) Tools and other equipment should use plugs and receptacles designed so that a plug of one voltage rating cannot be accidentally inserted into a receptacle of a different voltage rating.

(2) The possibility of exposing personnel to dangerous voltages can be minimized by grounding, interlocks, guards, and warning placards.

d. Technical and Mechanical Hazards.

(1) Any equipment which, in normal operation, exposes personnel to potential contact with surface temperatures in excess of 140°F (60°C) or 120°F (49°C) during operations requiring handling should be appropriately guarded. Surface temperatures induced by climatic environment are exempt but should be considered in design layout.

(2) All moving parts of machinery and transmission equipment, including pulleys, belts, gears, blades, etc., on which personnel may become injured or entangled should have a guard installed.

(3) Switches or controls that initiate a hazardous operation, such as movement of a hoisting crane (which requires the prior operation of a related locking control), should be identifiable.

(4) Equipment controls should be located and mounted so that access to them can be achieved without danger from electrical charge, heat, moving parts, chemical contamination, or other hazards.

48. SECURITY. Stations near industrial parks, accessible to the public or isolated from other occupied airport buildings, may require special security devices or features that increase security, particularly when firefighters are responding to a call. Security devices or features include automatic door closers and locks for all exterior doors, video surveillance, and sonic or photoelectric sensors.

49. PROVISIONS FOR WATER RESCUE EQUIPMENT. Sponsors of airports that lie near a body of water may own or operate appropriate water rescue equipment. If such equipment is housed at the fire station, then the station design should accommodate its unique water operation and maintenance features. This may include an emergency boat ramp, space for storing spare parts and accessories, and a facility for out-of-water engine start-up. AC 150/5210-13, Water Rescue Plans, Facilities, and Equipment, provides additional information.

50. COMBINATION FIRE STATION AND MAINTENANCE BUILDING. Some airport sponsors find it cost-effective to house aircraft RFF vehicles in a section of a building that otherwise houses maintenance equipment. This arrangement is satisfactory if the necessary personnel and facilities are available and if the choice of the site follows the conditions in this advisory circular. The space for housing aircraft RFF vehicles should be partitioned to safeguard against tampering with the vehicles and unauthorized use of rescue tools and equipment.

51. LANDSCAPING. Landscaping should be simple and economical to maintain. Avoid shrubs and trees that birds and animals find especially attractive and whose future root systems may damage the structure or underground utilities. Trees and shrubs should be planted so not to become obstacles to efficient grass-mowing and snow removal. Landscapers may consider installing sprinkler systems and hose bibs to facilitate ground maintenance. An effective landscaping is one that at least:

- a. Enhances the natural beauty of the area, is hardy, and able to tolerate local conditions.
- b. Gives scale and character to the station and its surroundings.
- c. Provides shade and some protection against wind and snow.
- d. Reduces noise, dust, and soil erosion and screens out views of undesirable sights.
- e. Does not obstruct the watch/alarm room's airside view either initially or, due to growth, in the future.

APPENDIX 1. SAMPLE AIRCRAFT RESCUE AND FIREFIGHTING VEHICLE
DIMENSIONS AND CHARACTERISTICS (PARTIAL LIST)

MANUFACTURER	MODEL	DIMENSIONS Ht. Wid. Lth. (feet)			WEIGHT (lbs)	PROBABLE CREW	PROBABLE FAA INDEX	WATER CAPACITY (gal)	FOAM CAPACITY (gal)	DRY CHEM CAPACITY (lbs)	COMMENTS
AMERICAN LA FRANCE	CFR 1500	11.67	9.33	2.75	44,000	2	B,C	1,500	200		
ANSUL	Magnum 440	6.7	6.7	18.2	8,580	1-2	A	100 AFFF Premix	450		
	Magnum 480	10.33	9.0	21.7	17,780	1-2	B	200 AFFF Premix	1,350		
CHUBB FIRE INTERNATIONAL	Pacer	8.86	7.54	19.35	11,020	1	A,B	237.6	23.6	110*	*Optional
	Pursuer	12.07	8.2	20.53	17,860	1	A,B	240	24		
	Protector (4 x 4)	12.07	9.51	29	41,670	2	B,C	1,583	100		
	Medium ACT	12	8.17	29	54,020	2	B,C	1,583	190		
	Heavy ACT	11.68	8.2	29	55,110	2	B,C	2640	317		
	Protector (6 x 6)	11.09	8.2	35.56	56,220	2	C,D	2,112	100		
	Patroller	12.5	10	32.9	60,630	2	B,C,D	2,640	317		
	Pathfinder	12.23	10	37.39	92,590	2-3	D,E	3,598	431		
EMERGENCY ONE, INC.	E-200 RIV	9.17	8	20	12,000 GVWR	1-2	A,B	200	20	350	Variations available
	C-750	10	8	25	27,000 GVWR	1	A,B	700	100	500	Variations available
	Titan I RIV	10.83	8.33	27.5	34,000 GVWR	1	A,B,C	600	70		Variations available
	Titan II CFR	10.83	8.33	27.5	36,000 GVWR	1	A,B,C	1,000	200		Variations available

Appendix 1 (continued)

MANUFACTURER	MODEL	DIMENSIONS Ht. Wid. Lth. (feet)			WEIGHT (lbs)	PROBABLE CREW	PROBABLE FAA INDEX	WATER CAPACITY (gal)	FOAM CAPACITY (gal)	DRY CHEM CAPACITY (lbs)	COMMENTS
EMERGENCY ONE, INC. (continued)	Titan III CFR	10.83	9.33	30	46,000 GWR	1-2	B,C	1,500	130		Variations available
	Titan IV CFR	12	9.33	37.67	69,000 GWR	2	C,D	2,500	360-380		Variations available
	Titan V CFR	12	9.33	36.67	69,000 GWR	2	D,E	3,000	380-410		Variations available
FIRE-TEC	DC 5WF 280/350P	10.25	8	23.75	24,500	1	A	280*	*	500	*Combined water and foam
	DC 15AF AF 250N	11	7.83	21.25	19,500	1	A,B	250*	*	1,500	*Combined water and foam
	WF1110/ 750P	10.17	8	23.17	33,500	1	A,B,C	1,110*	*		*Combined water and foam
	WF 2800/ 150PV	11.67	8	35.83	70,000	2	C,D	2,800*	*		*Combined water and foam
	WF 3400/ 1800P	11.67	9.33	35.83	70,000	2	D,E	3,400*	*		*Combined water and foam
FOREMOST INDUSTRIES	Maurauder 2	11.33	10.83	29.16	41,230	2	B,C				
	Maurauder 3	11.33	10.83	34.99	48,060	2	C,D				
GARSITE	CA 440C	7	8	19.83	10,500	1-2	A	N/A	100	450	
	GS RIV	10.5	8.2	27.5	41,130	1	A,B,C	1,000	150		
	4 x 4	10.5	8.17	27.58	37,500	1	B,C	1,500	150		
	6 x 6	10.5	8.17	27.58	56,000	1	D,E	300	300		
	G525 CFR	10.5	8.17	33.7	56,600	1-2	C,D	2,500	300		
	8A242	10.7	8.2	33.7	62,720	2	C,D	2,500	300		
	8A480 CFR	11.7	8.2	33.7	67,240	2	C,D	2,500	300		

Appendix 1 (continued)

MANUFACTURER	MODEL	DIMENSIONS Ht. Wid. Lth. (feet)	WEIGHT (lbs)	PROBABLE CREW	PROBABLE FAA INDEX	WATER CAPACITY (gal)	FOAM CAPACITY (gal)	DRY CHEM CAPACITY (lbs)	COMMENTS
LADDER TOWER, INC.	Trident 1000	13.17 9.33 32.00	45,000	1	A,B,C,	1,000	200	500 (Halon)	Has a 58 ft. aerial
	Trident 2500	12.92 9.33 39.48	69,000	1-2	C,D	2,500	300	500 (Halon)	Has a 58 ft. aerial
OSHKOSH	P-19	10.00 8.00 27.08	33,600	2	ALL	1,000	130		
	T-1500	11.58 9.33 29.67	42,500	2	ALL	1,500	195		
	DA-1500	10.08 9.33 36.5	64,000	2	ALL	1,500	265		
	T-2500	12.00 9.33 36.75	62,000	2	C,D,E	2,500	320		
	T-3000	12.00 9.33 36.75	66,750	2	C,D,E	3,000	405		
	M-12	13.8 10.00 46.7	101,170	2	D,E	3,000	515		
	M-15	13.8 10.00 46.7	109,500	2	D,E	4,000	515		
	M-23	13.8 10.00 46.7	130,680	2	D,E	6,000	515		
PRISMO	Confire 500	11 8 22.92	28,000	1	A,B	500	100	300	
WALTER EQUIPMENT	ZD-1000	11.33 8 26.3	38,290	1	A,B,C	1,000	120		
	EDG-1500	11.7 8 25.33	38,360	1	B,C	1,500	180		
	EDU-2500	11.83 10 29	47,960	2	C,D	2,500	300		
	EDT-3000	12 10 30.42	62,500	2	D,E	3,000	450		

APPENDIX 2. TYPICAL EQUIPMENT

1. TYPICAL STANDARD FURNISHINGS. The following list includes items typically purchased as part of the construction and furnishing of an airport rescue and fire-fighting station.

a. General Equipment (Mechanical).

- (1) Air Compressor
- (2) Hoist
- (3) Emergency Back-up
- (4) Vehicle Washing System

b. Electronic Equipment.

- (1) Alarm System
- (2) Clocks
- (3) Doorbell
- (4) Elapsed Time Indicator
- (5) Intercom system
- (6) Radio Monitor
- (7) Radios
- (8) Recording Systems
- (9) Telephones

c. Lights.

- (1) Emergency Lights
- (2) General Lights
- (3) Night Lights

d. Hardware.

- (1) Doors and Equipment
- (2) Sliding Partition

e. Specialized Hardware.

- (1) Doorway Rollers (hose-drying room)
- (2) Foam Pump (permanent)
- (3) Slide Poles

f. Toilet Facilities.

- (1) Drinking Fountain
- (2) Fixtures
- (3) Handicapped Hand and Guard Rails
- (4) Janitor Mop Rack
- (5) Mirrors
- (6) Paper Towel Dispensers

- (7) Sanitary Napkin Dispensers and Disposals
- (8) Sinks
- (9) Soap Dispensers
- (10) Toilets
- (11) Toilet Tissue Dispensers
- (12) Waste Receptacles

g. Furniture Built-in.

h. Kitchen Equipment.

i. Fire Protection.

- (1) Entry System
- (2) Fire Extinguishers
- (3) Smoke Detectors
- (4) Sprinkler Systems

2. TYPICAL FIRE STATION ACCESSORIES.

a. Specialized Hardware.

- (1) Axes
- (2) Breathing Apparatus
- (3) Hose Racks
- (4) Hose, Washer, and Dryer
- (5) Pump (foam)
- (6) Refilling Equipment
- (7) Safety Mirrors
- (8) Simulators
- (9) Skin and SCUBA Equipment
- (10) Spare Cylinders
- (11) Stretchers
- (12) Trailer, Firefighting

b. Training.

- (1) Mannequins, Training
- (2) Slide Projector
- (3) Video Cassette Recorder

APPENDIX 3 EQUIPMENT PURCHASING CONSIDERATIONS

The following questions are among those that need to be addressed for each piece of equipment:

1. How many are needed now and in the future?
2. What sizes and types will be required?
3. Where should the item be stored?
4. Are there any special storage or handling problems associated with it?
5. What is the intended function?
6. Will this item require other equipment to support it? If so, what?
7. Can an alternative item be used?
8. Is the item really needed now or can it be acquired later?
9. How often will this item be used?
10. Why is this item needed?
11. Who will use this item or be affected by it?
12. Who will maintain the item and how?
13. Are special tools required to maintain it?
14. Will the item serve its intended purpose?
15. Will the item interfere with another item?
16. What is the useful life of the item and will a replacement be easily attainable?
17. Does the item need to be distinguished from another similar item? If so, how?
18. Does the item need to be secured?

APPENDIX 4. RESOURCES AND RELATED READING MATERIAL

1. ORGANIZATIONS.a. Station Design.

American Society of Heating, Refrigerating and Air Conditioning Engineers
(ASHRAE)
1791 Tullie Circle, NE
Atlanta, Georgia 30329
(404) 636-8400

American Insurance Association
Engineering and Safety Service
85 John Street
New York, NY

American Petroleum Institute (API)
1220 L Street NW
Washington, DC. 20005

American National Standard Institute, Inc. (ANSI)
1430 Broadway
New York, NY 10018

The Architectural and Transportation Compliance Board
Washington, D.C.
(202) 245-1801

Federal Aviation Administration (FAA)
800 Independence Avenue, SW
Washington, DC. 20591

Illuminating Engineering Society (IES)
345 East 47th Street
New York, NY 10017
(212) 705-7920

International Civil Aviation Organization (ICAO)
1000 Sherbrooke Street, West
Montreal, Quebec
Canada H3A 2R2
(514) 285-8222

National Fire Protection Association (NFPA)
60 Batterymarch Park
Quincy, MA 02269

National Concrete Masonry Association (NCMA)
2302 Horse Pen Road
P.O. Box 781
Herndon, VA 22070
(703) 435-4900

National Electrical Manufacturers Association (NEMA)
2101 L Street NW
Washington, DC 20037

National Plumbing Code (ASME)
345 E 47th Street
New York, NY 10017.

Occupational Safety and Health Administration (OSHA)
U.S. Dept. of Labor
Commerce Clearing House, Inc.
4020 W. Glenlake Ave.
Chicago, IL 60646.

b. Building Codes.

Building Officials and Code Administrator
4051 West Flossmoor Road
Country Club Hills, IL 60477
(312) 799-2300

International Conference of Building Officials
50 South Ronles
Pasadena, California 91101.

c. Kitchen Design.

National Kitchen Cabinet Association
P.O. Box 6830
Falls Church, VA 22046
(703) 237-7580

Society of Certified Kitchen Designers
124 Main Street
Hackettstown, NJ
(201) 852-0033

2. READING MATERIALS.

- a. Federal Aviation Administration. FAA AC can be obtained by writing to:
DOT, Utilization and Storage Section, M-443.2, Washington, DC., 20590.

AC 150/5070-6A, Airport Master Plans.

AC 150/5100-14A, Architectural, Engineering, and Planning Consultant
Services for Airport Grant Projects.

AC 150/5210-13, Water Rescue Plans, Facilities, and Equipment.

AC 150/5220-4A, Water Supply System for Aircraft Fire and Rescue
Protection.

AC 150/5220-14, Airport Fire and Rescue Vehicle Specification Guide.

- AC 150/5300-9A, Predesign, Prebid, and Preconstruction for Airport Grant Projects.
- AC 150/5360-11, Energy Conservation for Airport Buildings.
- AC 150/5370-2C, Operational Safety on Airports During Construction.
- AC 150/5370-12, Quality Control of Construction for Airport Grant Projects.
- FAA-RD-78-105, Full-Scale Fire Modeling Tests of a Compact Rapid Response Foam and Dry Chemical Powder Dispensing System.
- FAA-STD-019, Lightning Protection, Grounding, Bonding and Shielding Requirements for Facilities.

b. Department of Transportation

- 49 Code of Federal Regulations, Part 27, Non-discrimination on the Basis of Handicap in Programs and Activities Receiving or Benefitting from Federal Financial Assistance.

c. Airport Master Planning.

Ashford, Norman, and Paul Wright. Airport Engineering.

Hornojeff, Robert (dec.) and Francis X. McKelvey. Planning and Design of Airports (third ed.). New York: McGraw-Hill.

d. Station Design.

American National Standard Institute (ANSI) A117.1-1980, Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

American National Standard Institute (ANSI) Z 35.1-1972, Specifications for Accident Prevention Signs.

American Petroleum Institute Publication 1615-79, Installation of Underground Petroleum Storage Systems.

American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE), Handbook of Fundamentals.

Design of Fire Stations. University of Washington.

Fire Station Design. Vol. 8. The Circul-Air Corporation, Detroit, MI, 1973.

Human Engineering Guide to Equipment Design (rev. ed.). American Institutes for Research: Washington, D.C., 1972.

Monsanto Chemical Company, Acoustical Glazing Design Guide. 800 North Lindbergh Boulevard, St. Louis, Missouri 63167.

Underwriters Laboratories (UL), Inc., Standards for Lighting Fixtures.

U.S. Air Force Definitive Drawing Manual No. AFM 88-2.

e. Kitchen Design.

American National Standard Institute. Recommended Construction and Performance Standards for Kitchen and Vanity Cabinets. ANSI A161.1, 1980. Conran, Terrence. The Kitchen Book. New York: Crown Publishers.

The Editors of Consumer Guide. Whole Kitchen Catalog. New York: Simon and Schuster, 1978.

Hylton, William H. (ed.) Build Your Harvest Kitchen. Emmanus, PA: Rodale Press, 1980.

Modi John. The Best Kitchen Remodeling Workbook. Chicago: Contemporary Books, 1978.

f. Laundry Facilities.

Reader's Digest Complete Do-It-Yourself Manual. The Reader's Digest Association, Inc., Pleasantville, New York, 1973.

g. Physical Plant.

American Standard Safety Code for Elevators, Dumbwaiters, Escalators and Moving Stairs. Publication No. A17.1 (latest ed.). The American Society of Mechanical Engineers, United Engineering Center, 345 E. 47th Street, NY, NY 10017.

Heating, Ventilating, Air Conditioning Guide. American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. 234 5th Ave., NY, NY.

IES Handbook. Illuminating Engineering Society, 1860 Broadway, NY, NY. Lightning Protection Code, NFPA-78. National Fire Protection Association.

National Electrical Code. National Fire Protection Association (NFPA), 70 Batterymarch Park, Quincy, MA 02269.

National Fire Protection Association Codes for Standards and Recommended Practices. Volumes 1 through 16, National Fire Protection Association.

National Plumbing Code. Publication No. A140.8, ASME 345 E 47th Street, NY, NY 10017.

1985 Basic National Building Code. Building Officials and Code Administration, 4051 West Flossmoor Road, Country Club Hills, IL 60447.

Occupational Safety and Health Standards. U.S. Dept. of Labor, Occupational Safety and Health Administration, Commerce Clearing House, Inc. 4020 W. Glenlake Ave., Chicago, IL 60646.

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Uniform Building Code, Vol. 1 (current edition). International Conference of Building Officials, 50 South Ronles, Pasadena, California 91101.

h. Aircraft Rescue and Firefighting Equipment.

Aircraft Rescue and Fire Fighting Vehicles. NFPA 414. National Fire Protection Association (NFPA), Batterymarch Park, Quincy, MA 02269.

International Civil Aviation Organization. Airport Services Manual, Part 1: Rescue and Fire Fighting, second ed. 1984.

National Fire Protection Association (NFPA). Fire Protection Reference Directory and Buyer's Guide, Annual Directory. National Fire Protection Association (NFPA), Batterymarch Park, Quincy, MA 02269.

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Appendix 5

APPENDIX 5, KEY WORDS FOR LITERATURE SEARCH

Aircraft Rescue and Firefighting System

Airport

Airport Emergency Equipment

Airport Master Planning

Building Code

Crash Fire Rescue

Crash Trucks

Design Criteria

Emergency Vehicle Design

Fire

Fire Detection

Fire House

Fire Houses

Fire Protection

Fire Resistance

Fire Station

Fire Stations

Fire Suppression

Government Buildings

Life Safety

Municipal Buildings

Public Buildings

